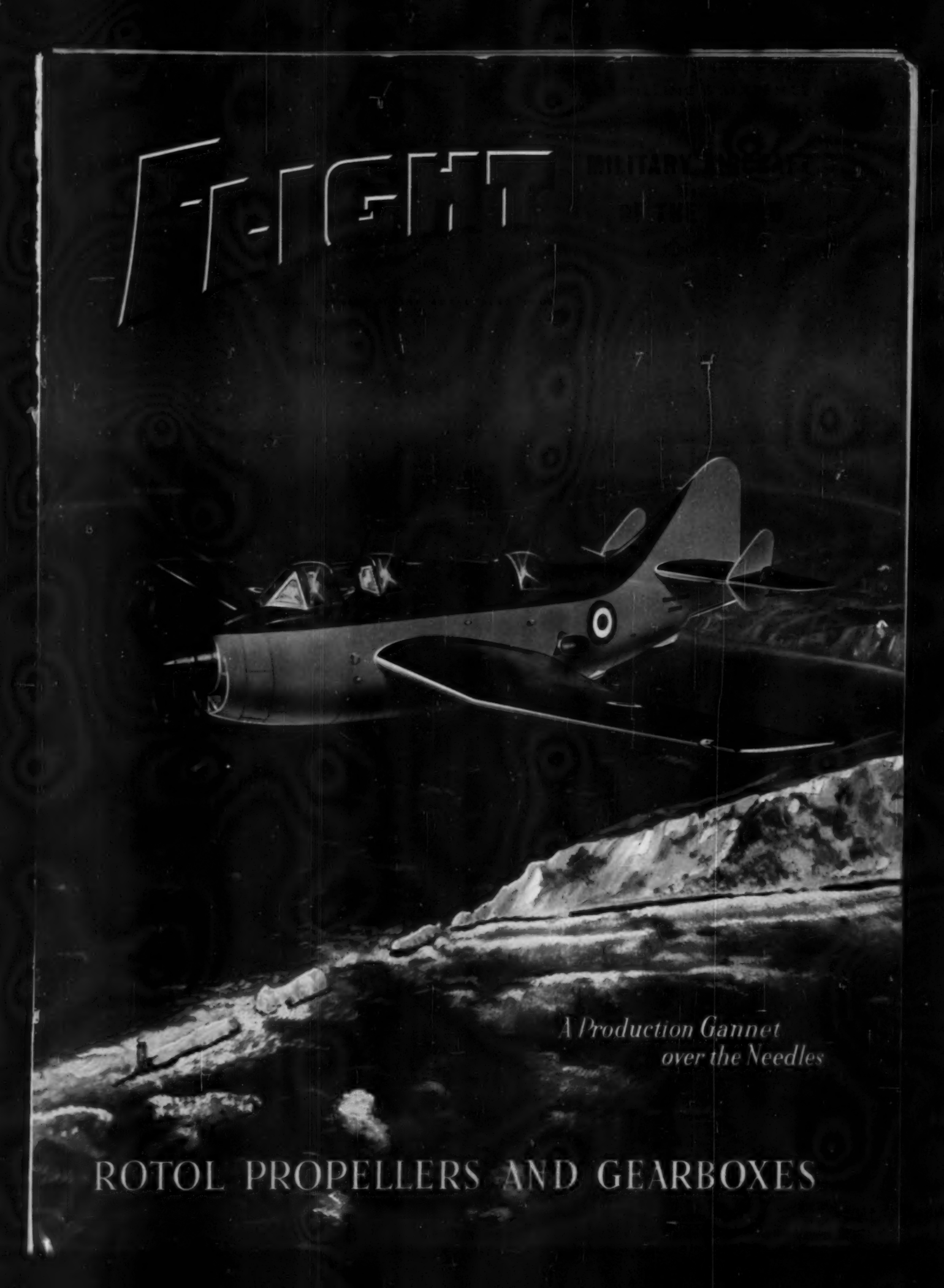
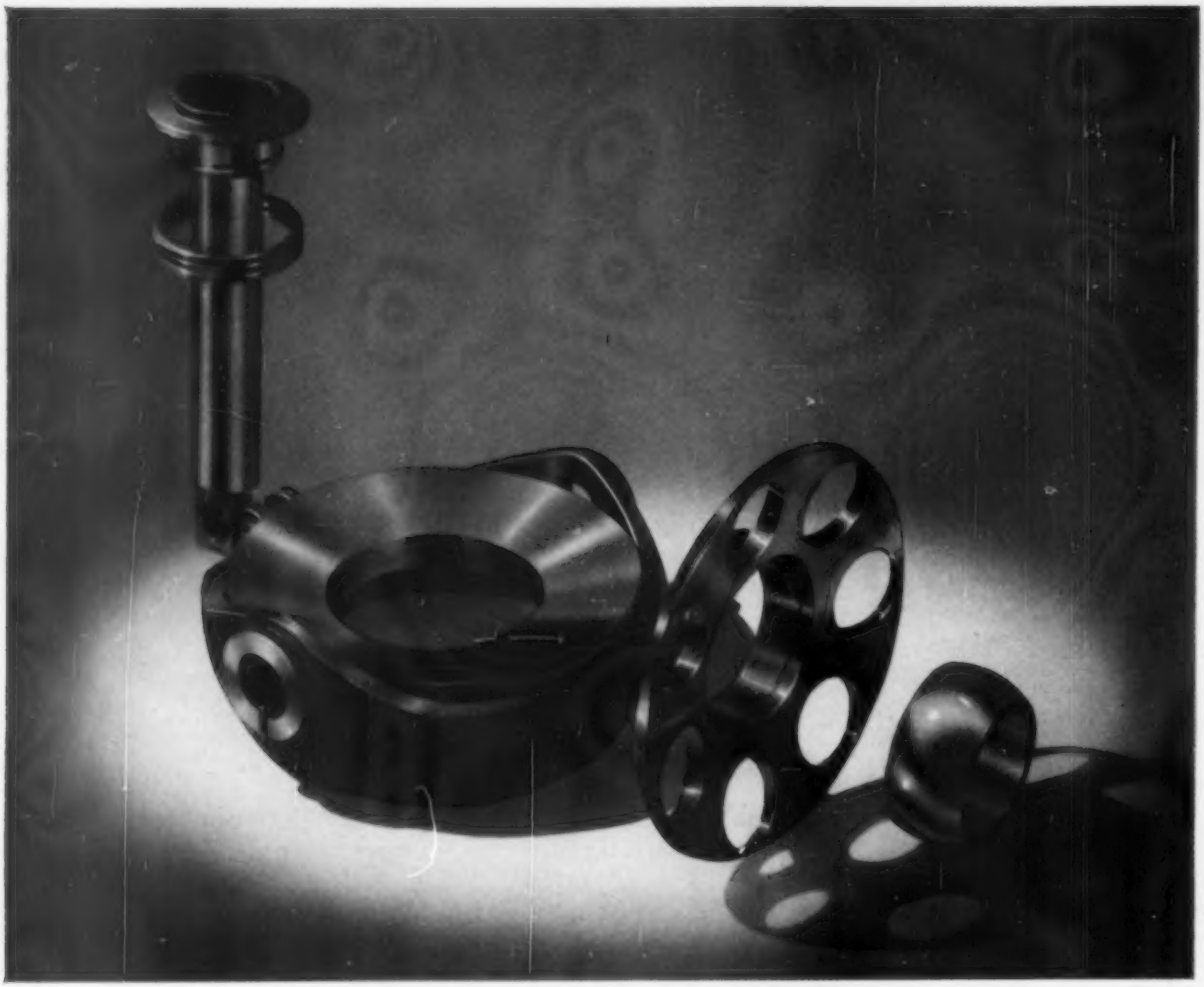
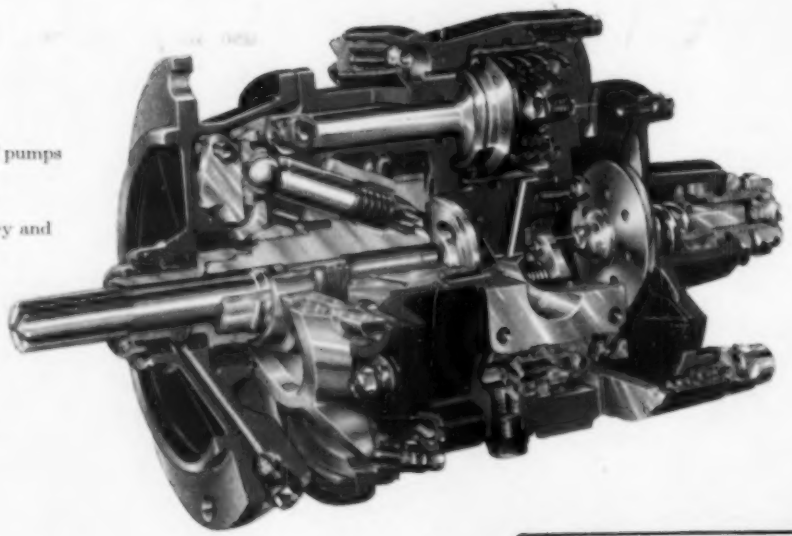


A Production Gannet over the Needles

ROTOL PROPELLERS AND GEARBOXES





These components for the range of pumps designed and manufactured by us are of extreme dimensional accuracy and super finish, and are the operative parts in varying the delivery of self-governing, 2,000 p.s.i., fuel pumps. Three basic pumps cover present engine requirements with deliveries of 460 to 2,800 gallons per hour.

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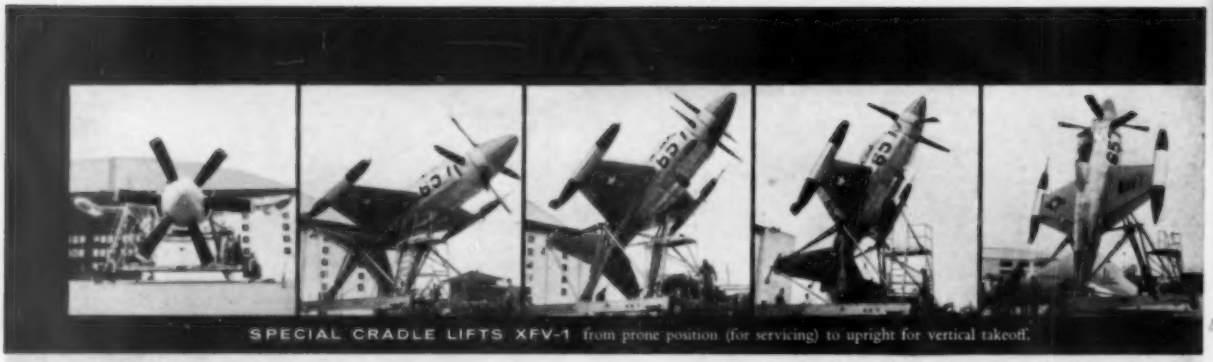
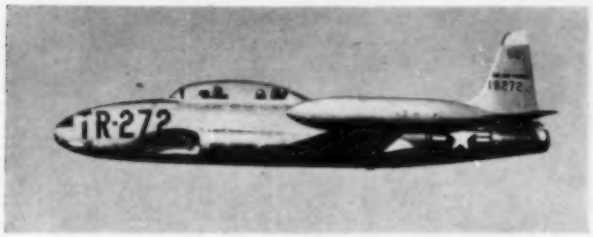


SPECIAL CRADLE LIFTS XFV-1 from prone position (for servicing) to upright for vertical takeoff.

LEADERSHIP DEMANDS CONSTANT ACHIEVEMENT



WORLD'S LEADING JET TRAINER, Lockheed's famous T-33, today serves 12 nations in 22 countries. In the United States 9 out of 10 jet pilots receive their training in this dependable high-speed two-place jet trainer.

GUIDED MISSILE and pilotless aircraft research is advancing rapidly at Lockheed. Here engineer-scientists from the Missile Systems Division test top-secret developments to meet problem of supersonic speeds yet unattained.

Scientists Unveil Radical Forms of Flight

High-Speed Navy Fighter Takes Off Straight Up, Lands by Backing Straight Down on Its Tail

Today's biggest news in aviation is the Navy's XFV-1 built by Lockheed—first successful vertical-rising plane designed on a different concept from the helicopter.

A powerful Allison turbo-prop engine with two jet turbines turning counter-rotating propellers lifts the XFV-1 straight up, rocket fashion. It levels off for speeds in the 500-m.p.h. class, lands on its tail.

Exclusive feature of the Lockheed XFV-1 is its added ability to make conventional takeoffs and landings—very important to pilot training, because it permits flying practice at high altitude prior to the pilot's first tail-down landing.

The XFV-1 makes every open space a landing field, every ship an aircraft carrier. Points to the day when most U.S. fighters may take off vertically from anywhere.

FASTER THAN EVER is the Navy's long-range P2V patrol bomber now that it has *two* kinds of power—with jet pods recently added to its turbo-compound engines. Increases its effectiveness in vital shore defense. Photo shows the P2V Neptune flying on jet engines only.

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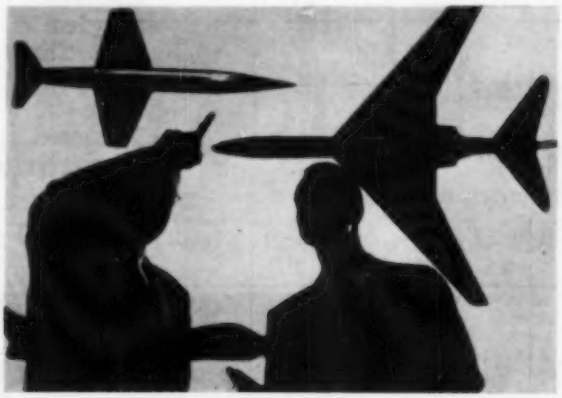

NEW FLIGHT FORMS are studied by Lockheed scientists to meet sonic and thermal problems of ultra-high speed, higher altitudes. At Lockheed's Hall of Science each development represents years of research, testing, proving—in man's continual invasion of the unknown.

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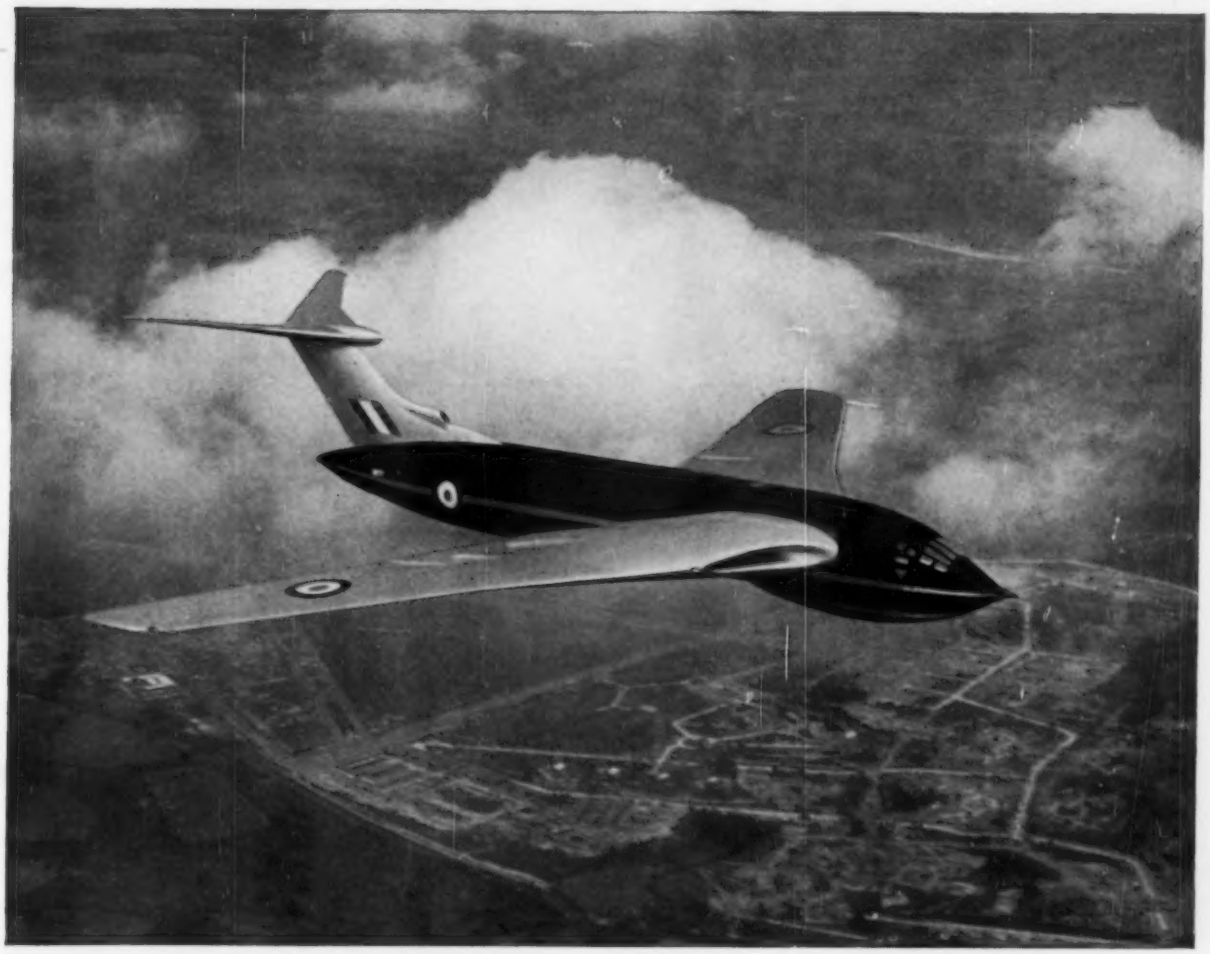

Latest addition to the offensive armoury of the R.A.F., the Victor is a formidable aircraft by any standards and Titanine are proud to be associated with the designers and builders of this famous machine. As still higher speeds are attained, the role of aircraft finishes becomes increasingly important. Thus the programme of experiment carried out by the Titanine research team plays a full part in the rapid development of our aircraft industry.

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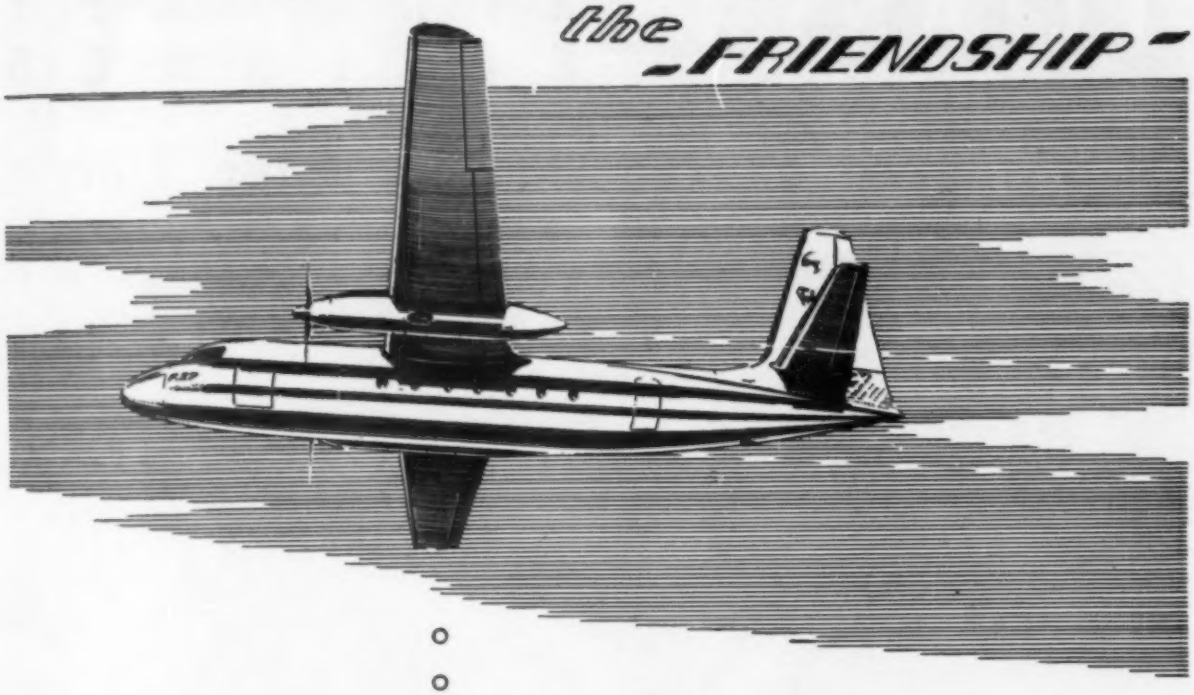

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The illustrations show the PALMER *foot rest and operating pedal unit and the complete rudder bar assembly.*

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with a difference you can feel

Foot-operated braking is now obligatory for aircraft ordered for the R.A.F. and the Fleet Air Arm. The PALMER TOE PEDAL BRAKE CONTROL, C73, operates pneumatically and is designed for supply pressures up to 450 p.s.i. delivering a brake line pressure up to 300 p.s.i.

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Equal braking is obtained on port and starboard wheels by equal foot pressure on the pedals attached to the rudder bar. Differential action is obtained by variation of foot pressure on individual pedals.

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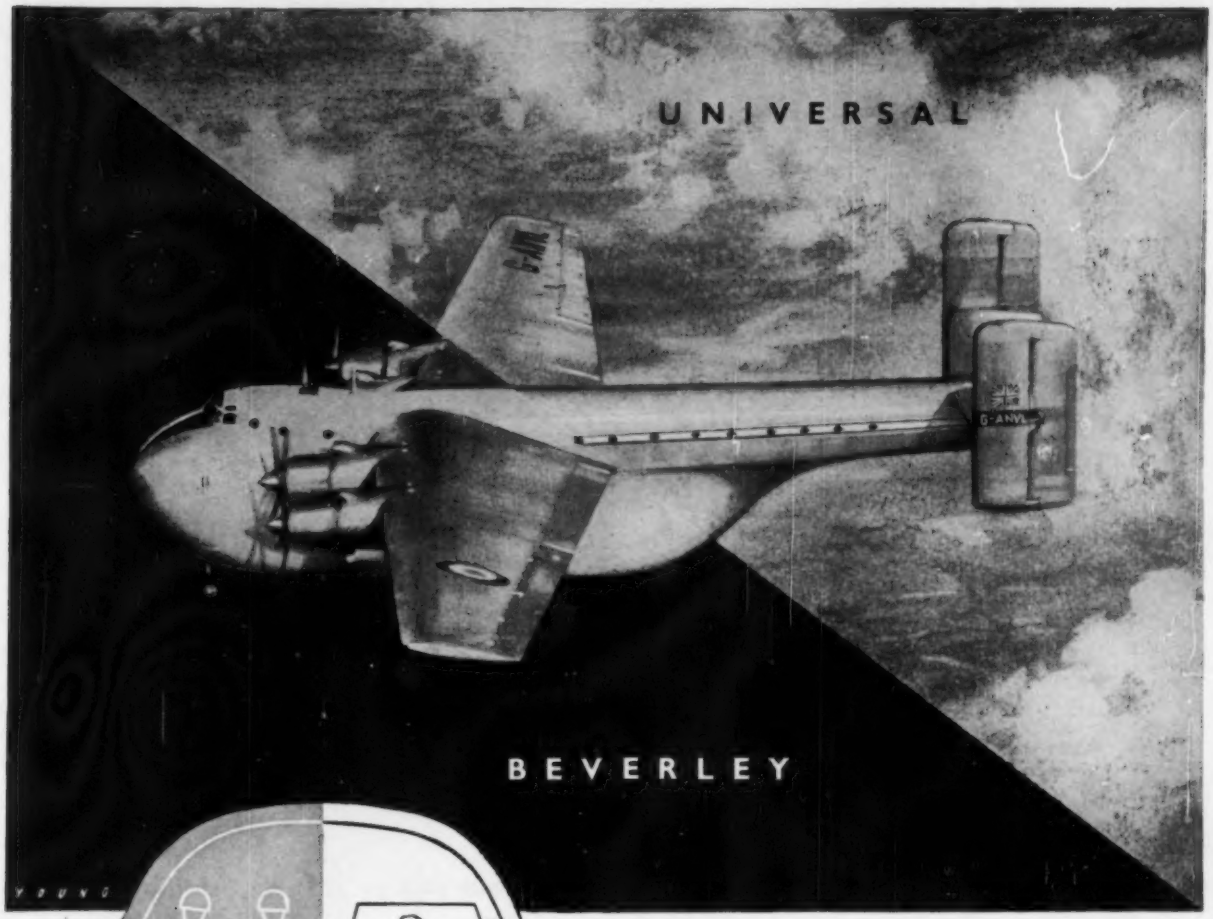

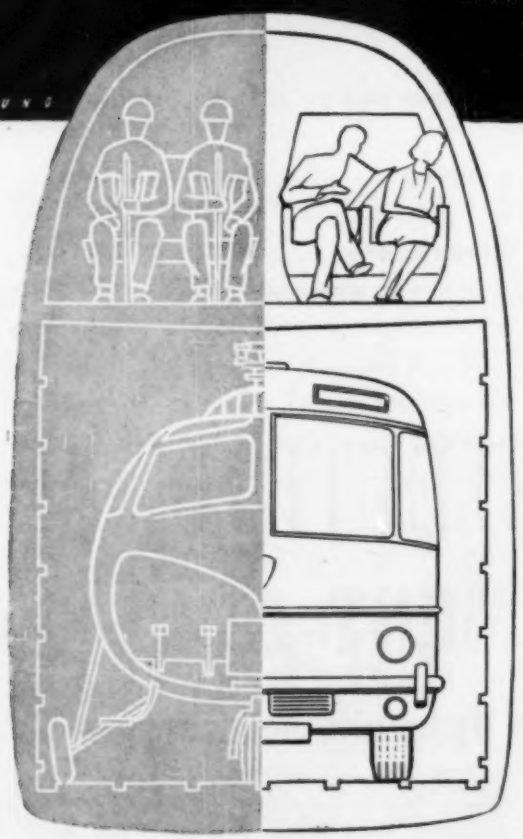

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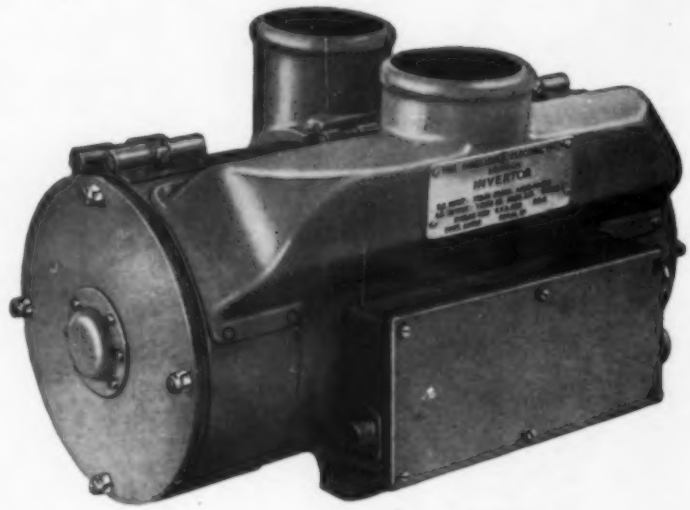

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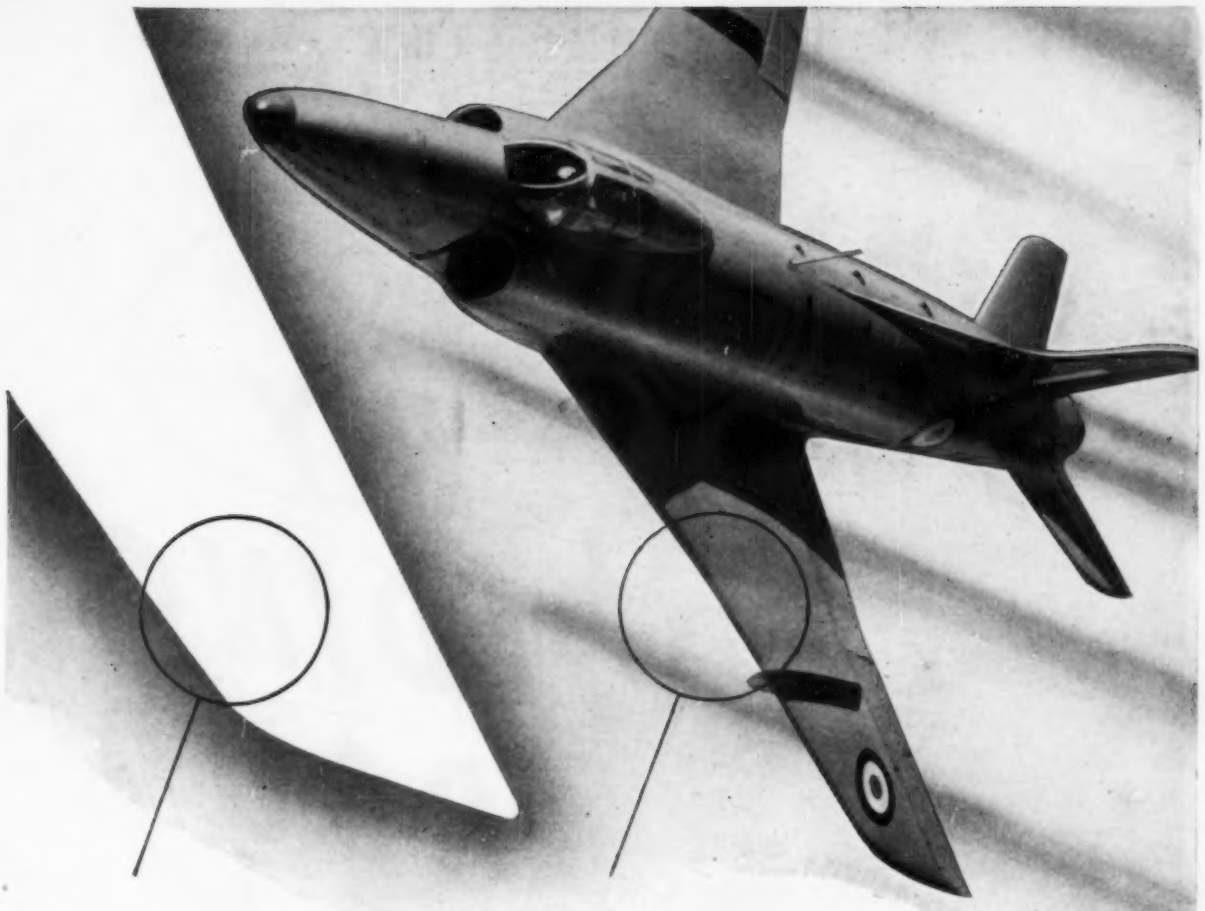

PAINT versus DUST...

"THE SWIFT"
Acknowledgements to Vickers-Supermarine.

In these supersonic days the leading edges of some aircraft look as if they've been sand-blasted. Yet the real cause of this pock-marked surface is — dust ! Yes, those tiny, everyday dust particles you see eddying round in the sunlight can actually *damage* a plane travelling at many hundreds of miles an hour.

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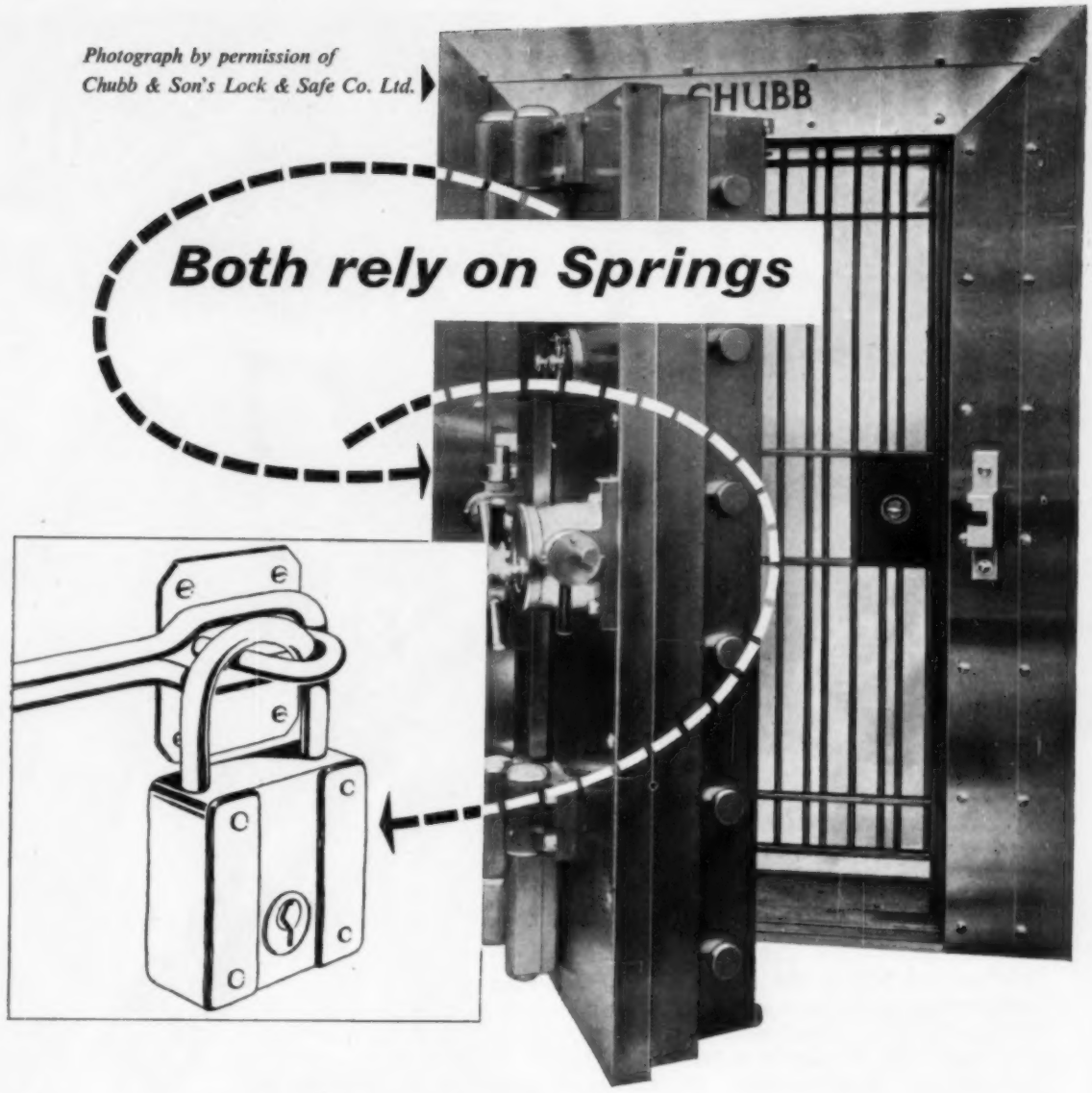

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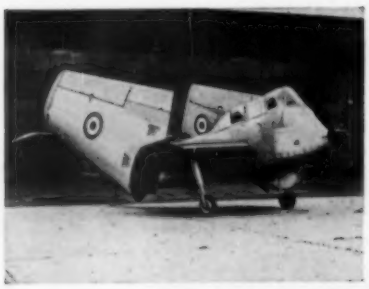

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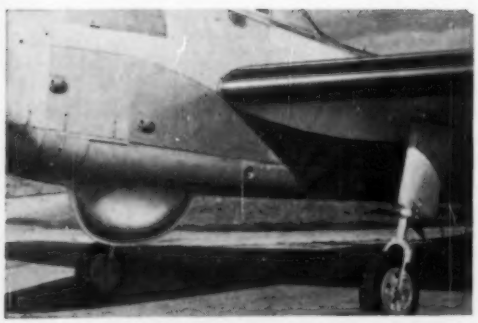

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Founded 1909

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Portentous Decision

DEPENDING upon a decision which Mr. Lennox-Boyd will be asked to make during the coming month or two we may all have reason to look back on this week as one of extreme importance to civil aviation. We refer to his acceptance or rejection of the broad plan for the training of merchant airmen, put to him last Wednesday by a committee representing every important organization concerned. Readers will find the salient points of argument and proposals on page 812 of this issue. Many will recognize them as the patiently distilled product of almost innumerable opinions and suggestions, a number of which have found a place in our pages during the last two years.

We would recall the leading article in our January 1st issue which then brought up to date the well-informed thinking on the subject of training merchant airmen and of providing an opportunity for young men of suitable type to choose, train for and follow the calling of civil air pilot. This article was preceded by another on the same subject twelve months earlier. These matters have in fact been the close concern of *Flight* at each stage; thus they represent no sudden enthusiasm.

It is our earnest hope that the Minister and his colleagues in other departments will recognize the sincerity of this approach from a deputation of experts.

Are we to lay the foundations of a national scheme which will provide first-class captains of aircraft for years to come, or are we for the sake of £¼ million p.a. to allow aircraft costing up to five times that figure and carrying 100 or more passengers to be crewed more or less haphazardly? That is the real question to be answered.

The Vickers' Hundred

A LEADER should live up to its title and not be a follower; nevertheless we have no hesitation in congratulating Vickers following the signing last week of still another Viscount order, bringing their total to the century—firm and without extras. This fine and well-merited achievement holds the added virtue of including an American domestic order—the first for a turboprop airliner. The significance of this fact needs no elaboration; just how far-reaching may be the effect one can but surmise.

We are happy to think, incidentally, that it is a comparatively small Australian independent operator whose order has brought the total to 101. There are few individuals in Australia who cannot be described as independent and few indeed who are not glad to be batting (in this context) for the old country. Nevertheless it must have taken courage and confidence to purchase new equipment so large and expensive by comparison with anything the company has operated hitherto.

It is no coincidence, we feel, that the Vickers success story should concern an aircraft about which there has never been any secrecy or "we know all the answers and you cannot tell us anything" attitude. We cannot forbear to remark, too, that everything to do with the Viscount reflects the attitude and geniality of George Edwards, who has all along been primarily responsible for it. That the great firm of Rolls-Royce provides the Dart turboprops has undoubtedly set the seal on the Viscount's fortunes.

If we may judge by the pronouncements of satisfied customers both in possession and awaiting their turn for delivery, there is no doubt that Vickers have always been ready to co-operate and to profit by operators' advice and experience. There is little doubt that Mr. J. H. Carmichael's Capital Viscounts will be that much better suited to his needs because of the detail modifications incorporated earlier at T.C.A.'s request.

Referring to the Viscount's operating record as outstanding, the Capital president said that his airline had been looking for an airliner that met its requirements and the Viscount was it. "I couldn't be more pleased if it had been designed to our specifications."

We recall, too, that Gordon McGregor, president of T.C.A., whose fifteen Viscounts will operate into American cities, commented: "This aircraft has been selected on its merits in open competition, and we are confident that it will prove a most valuable addition to our North American fleet."

These pronouncements indicate a right and sound basis for sales and a pleasant atmosphere in which to do business. And one should not overlook the foresight and help of the first operators to appreciate and order this turboprop aircraft: B.E.A., Aer Lingus and—*zut alors* or not—Air France.

FROM ALL QUARTERS

ITALIAN INTEREST: The Fokker S-14 Mach-Trainer was recently inspected and flown by a mission from the Italian Air Force. Seen here are Gen. Urbani, Chief of Staff, and Lt-Cols. Onofri, Franchina and Giglia. Fritz Diepen, Fokker's commercial manager, shows them round the cockpit. NATO may order the S-14.

Civil Pilot Supply: A Call for Action

OVER the past seven years a great many words have been spoken and written on the subject of training civil pilots, but little official action has been taken. On June 16th it was announced that the Minister of Transport and Civil Aviation, Mr. A. T. Lennox-Boyd, had received from Air Marshal Sir Guy Garrod, chairman of the Air League of the British Empire, a memorandum stating that "It is now urgently necessary to place the recruitment of pilots for civil aviation upon a firm and permanent basis."

The memorandum represents the results of several months' study by a working party representing the most important bodies in British civil aviation. These bodies, who fully support the proposals, are the Air League; Airwork, Ltd.; B.E.A.; B.I.A.T.A.; B.O.A.C.; B.A.L.P.A.; and G.A.P.A.N.

The memorandum recalls that operators have felt increasing anxiety about the supply of civil pilots for several years, and that as long ago as 1947 this led to the appointment of the Wilcock Committee. It points to a number of weaknesses in the present system of relying primarily on the R.A.F. as a source. These include: the fact that the best of young R.A.F. officers are retained on permanent commissions; fluctuations in the flow of suitable ex-R.A.F. pilots; fundamental differences between the tasks of Service and civil aircrew; and the lack of suitable technical grounding on many important civil-aviation subjects during R.A.F. training.

Urging that the recruiting policy for commercial pilots should be the same as for other professions, the memorandum suggests a scheme based on the following points:—

Selection of candidates, in the 16-18 age group, of G.C.E. standard with a bias towards science and mathematics. The selection board would comprise representatives of the operators, the M.T.C.A. and the Board of Education.

Ab initio training, including passing the P.P.L. tests, at a civil flying club, involving 50 hr flying. The candidate would also begin technical training, full time or at evening classes.

Further training, lasting two years, for a Commercial Pilot's Licence and Instrument Rating at an approved establishment. With a C.P.L., and 250 hr flying experience (including 100 hr on twins), the candidate would be eligible for employment. Training towards senior licences would be at the expense and in the time of the operator. The memorandum says it is essential that candidates should be exempt from National Service.

Cost:—A wastage of 5 per cent per annum among civil pilots could be expected during the next few years, requiring 70-120 new pilots annually. Allowing for an inevitably high wastage among recruits, it would be necessary to offer courses to some 400 boys annually. The corresponding total cost would be in the region of £250,000 p.a. The scheme would be financed through existing educational channels by means of State scholarships, obviating claims for financial assistance not available to entrants to other professional careers. The candidate would shoulder part of the cost of his maintenance while under training.

Soviet Air Day Disclosures

THE traditional Soviet Air Day display took place at Tushino on June 20th. First, 32 Yak-18 trainers paraded portraits of Lenin and Stalin, and streamed the flags of the sixteen Soviet Republics. Then another group spelt out "Glory to the CPSU (Communist Party of the Soviet Union)," and two more (one flown by a woman) and a Yak-11 performed aerobatics. Radio-controlled models—3½ m in span and weighing 5 kg—were eclipsed by a demonstration of a flapping-wing glider, described thus: "In the sky appears, towed by an aircraft, a graceful glider with long slim wings. The glider breaks the tow and we see quite clearly that the glider begins to flap its slim wings like a sea bird. . . . The glider is designed by a young Ukrainian designer, Alexander Yrkevich. He has called it Koshuk. The wind-stream raises the glider's wing, gathering air in a special chamber. The energy thus gathered forces the wing to flap. The wind-stream not only supports the glider but actually amplifies the energy, enabling exceptionally long flights to be made." Next came a formation of A-9 gliders, led by a woman, and these concluded the civil part of the celebration.

It was now the turn of the Air Force, under Lt. Gen. Rubanov. A Mikoyan swept-wing jet fighter performed aerobatics, and others followed suit in formation. Ten twin-jet bombers flew past, and forty-four helicopters landed in a "chess-board" formation, whereupon they disgorged units of soldiers, with light artillery.

"This was followed," runs one report, "by the dropping of six paratroopers, one of whom was making his 450th jump. Yet another mass drop of paratroopers was made from Antonov carriers. . . . When they cleared the field dozens upon dozens of transport planes appeared, each carrying about 30 soldiers, who jumped *en masse*."

The Soviet radio network subsequently stated that "glider trains"—transport aircraft each towing three troop-carrying gliders, all piloted by sports pilots—had taken part in fly-pasts in various localities that day. There was a talk by aircraft designer Merkulov, who averred that the first jet aircraft was designed in 1881 by the man who made the bomb which killed Czar Alexander II. It was in his death-cell in the fortress of St. Peter and Paul, said Merkulov, that the revolutionary Nikolak Ivanovich Kibalchich had drawn up his plans a few days before his execution, requesting that, after his death, they should be submitted to experts. In their "impotent wrath," however, the Czarists suppressed Kibalchich's work, which remained hidden in the Police archives. Kibalchich's idea had subsequently been taken up and developed by the Soviet inventor Ciolkovsky, who had proved the necessity of designing an engine running on liquid fuel. Kibalchich's followers carried the invention a step further, and in the years 1930-32 a liquid-fuel "jet engine" had been tested. The first such, for use in aircraft, had been built in 1939 by Dushkin.

Merkulov revealed that in a recent test flight a Soviet jet aircraft had attained a speed of 2,650 k.p.h. (1,645 m.p.h.) at a height of 21 km (13 miles); its fuel ran out after a flight of 4½ min. A fighter had reached about 2,000 k.p.h. in a dive.

FOR THE OUTBACK? At present operating a Heron and DC-3s, Mr. C. A. Butler, chairman and managing director of Butler Air Transport of Australia, is in London discussing his order for Viscounts. He is with Mr. R. C. Handasyde, of Vickers-Armstrongs (holding V.1000 model).

Viscount Order Book

WITH the signing of an order for two Vickers Viscounts for Butler Air Transport (photograph below), the total of *firm* orders has reached 101. The breakdown of this fine total is as follows: B.E.A., 38; Air France, 12; Aer Lingus, 4; Trans-Australia Airlines, 6; Trans-Canada Airlines, 15; British West Indian Airways, 4; Hunting-Clan Air Transport, 3; Iraqi Airways, 2; Fred Olson Air Transport, 2; Indian Air Force, 2; Canadian Department of Transport, 1; Misrair (Egypt), 3; L.A.V. (Venezuela), 3; Capital Airlines (U.S.A.), 3; Butler Air Transport (Australia), 2.

The total value of these orders, including spares provision, amounts to about £27m, of which over £16m are for the 60 Viscounts for export. In addition, options are held by Capital Airlines (for 37 Viscounts) and Butler Air Transport (for 4). The Rhodesian Government has just approved a loan for the purchase of 5 Viscounts by Central African Airways, and orders for some 50 other Viscounts are in process of negotiation, including, we believe, some specially equipped, for the Queen's Flight.

Swiss Convair Lost

CARRYING five passengers and a crew of four, Swissair Convair 240 HB-IRW descended into the English Channel near Folkestone late on Sunday, June 20th. The crew and two passengers were rescued, but two women and a child were lost. The aircraft was making a scheduled flight from Geneva to London. It is reported that the captain noticed that fuel was abnormally low, possibly as a result of a leak, just after crossing the French coast. He decided to try to reach Manston, but both engines stopped over water. There was no survival equipment aboard. I.C.A.O. Annex 6 requires the carriage of lifejackets only when a transport aircraft flies more than 30 min from shore at cruising speed (one engine inoperative), although more stringent requirements are sometimes applied by national or company regulations.

Airwork-Blue Star Link

IT WAS announced last week that the Blue Star Line, Ltd., has acquired a substantial interest in Airwork, Ltd., and that the shipping company is appointing two directors to Airwork's board. It may be recalled that Airwork is already closely associated with Furness, Withy and Co., Ltd., whose ships operate to the U.S.A., Canada, Australia, New Zealand and the Mediterranean. The Blue Star Line operates to Australia, New Zealand, South America, South Africa and the North American Pacific coast.

Northern Heights Gala

ON Sunday, June 20th, the Northern Heights Gala Model Aircraft meeting was held at Hawker Aircraft, Ltd., Langley airfield, Bucks. The main competition of the day was for the Queen Elizabeth Cup (presented by Lady Boyle, wife of Air Marshal Sir Dermot Boyle, to the winner, C. J. Marsh, of St. Albans—aggregate 687 seconds), a duration contest for powered aircraft. Besides this cup, many other awards were competed for, and the air was filled throughout the day with gliders, rubber- and diesel-powered models, and with control line creations of all types; luckily the weather held good, and the full programme was completed.

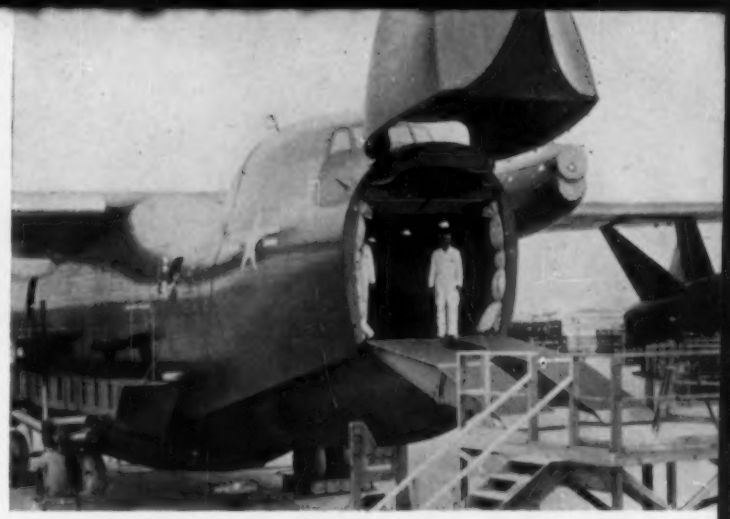
Canberra Tour—Continued

AS recorded in *Flight* of last week, the team of No. 27 Squadron Canberras landed at Athens on June 8th on the third stage of their goodwill tour of Europe. The weather had been dull and chilly during the earliest stages of the tour, but by the time they reached Athens the crews were wearing ventilated suits and taking salt tablets to reduce excessive perspiration while they waited in their cockpits on the ground.

The team first landed at Hellenikon, Athens, and were welcomed by A.V-M. Doukas, Vice-C.A.S. of the Royal Hellenic Air Force. Many R.H.A.F. officers trained in Rhodesia or England and served with the R.A.F. during the war, and many links still exist between the R.H.A.F. and the R.A.F. On the evening after their arrival they were entertained at a reception given by the C.A.S. of the R.H.A.F., Air Marshal Kelaidis.

The following day the six aircraft split up into two formations of three, one team flying to Larissa, the H.Q. of No. 28 Tactical Air Force and of No. 110 Combat Wing (F-84s). The other formation visited Elevsis, where R.H.A.F. pilots convert on to T-33s and F-84s after preliminary training at Tatoi on Tiger Moths, Harvards, Spitfires and Hellcats.

By June 17th the force had gone on to Belgrade, and—in spite of transport difficulties—many thousands of Yugoslavs made their way to the military airfield of Batajnica, 15 miles from the city, to see the Canberras perform. In the evening the jet bombers put on an impressive display, supplementing it with low-level flights over Belgrade itself for the benefit of immense crowds on the roofs of prominent buildings.



SNOOTY: Although it lacks airscrews, this Convair R3Y-2 Tradewind can show off its new bow-loading door and integral ramps. In production for the U.S. Navy at San Diego, these 400 m.p.h., 80-ton transport flying boats should be in service later this year.

A Flap at Bristol

IT can now be revealed that the first prototype Britannia was involved in a minor mishap about a month ago. During modification to bring G-ALBO up to the standard of production aircraft, in order to undertake C.o.A. trials, a non-standard portion of the flap linkage was fitted and passed by an inspector, although it was not in accordance with the drawings. During flight trials, with W/C. W. F. Gibb at the controls, this component failed. As a result, flap was applied on one side of the aircraft only, and the Britannia turned on its back. During the resultant pull-out the airframe was stressed beyond its design loading, but W/C. Gibb made a normal landing. This incident can have no bearing on any production machine.

OTHER AIR NEWS

NEGOTIATIONS are in progress for the supply of 30 Hawker-built Hunters to the Danish Air Force.

IN the normal course of his flying training, H.R.H. The Duke of Edinburgh has graduated to the Boulton Paul Balliol. On June 16th he was airborne from White Waltham in a Balliol T.2, accompanied by his instructor F/L. Caryl Gordon, for 30 minutes' familiarization with the type.

NEW aircraft designations are Canadair CL-28 for the Britannia sub-hunter, and Hurel Dubois H.D.35 (an anti-submarine development of the H.D.32) and H.D.36 (another version of the same basic type, equipped as a flying classroom for radar/navigation instruction).

IN an effort to make more efficient use of the manpower and finance at the disposal of the Royal Air Force, a special committee has been convened. Among its members will be Air Chief Marshal Sir Leslie Hollinghurst (who was Air Council Member for Personnel when he retired in 1952), a serving Air Vice-Marshal, a senior civil servant, and two prominent businessmen: Mr. S. V. Swash, chairman of Woolworth Stores, and Mr. F. C. Hooper, managing director of Schweppes, Ltd.

VARIOUS newspaper accounts of plans to boost Viscount production to a rate of 100 per year at Hurn by the autumn are incorrect. Vickers say that, in fact, two new hangars will be ready at Hurn in September, permitting output to be increased from three to five Viscounts per month. Eventually, should there be sufficient demand, production *could* be raised to eight per month.

LAST Sunday, the Italian newspaper *Il Tempo* claimed that a Piaggio P-136L amphibian (two 250 h.p. Lycoming) had flown about 1,850 miles non-stop from Brescia, N. Italy, to Luxor, Egypt. The crew were both women: the Marchesa Carina Negrone and Signora Ada Marchelli. This has been put forward as a world record non-stop flight for a twin-engined amphibian, although it could easily be beaten by a Grumman SA-16 Albatross.

AT Bordeaux-Merignac airfield on June 18th a short ceremony marked the transfer of the first French jet fighter to the air forces of NATO. The aircraft was the first "off-shore" Dassault Mystère IV, and it was "handed over" by the Chief of Staff of the French *Armée de l'Air*, Gen. Fay, to Gen. Parker of the U.S.A.F.

CROYDON Airport, due to close in a few years' time, will possibly be bought by various local authorities. A suggestion has been made that a British Museum of Aeronautics might well be established there, and the site has some chance of becoming a helicopter station.

HERE AND THERE

INTO THE PICTURE: "Flight's" new Gemini fitted with 145 h.p. Gipsy Major engines is now in commission. The colour scheme is royal blue, grey, white top, all outlined in red. The aircraft carries dual controls and the latest Plessy P.T.R.61 V.H.F. radio. The work of conversion, painting and refitting was done at Wolverhampton by Ron Paine, who is here seen flying with the Editor.

Appropriated

SPEAKING in Washington last week, Mr. Harold Stassen, the director of the American Foreign Operations Administration, announced that his department had agreed upon a sum of $85m (£30,360,000) as payment for "military aircraft manufactured in Britain for the use of the Royal Air Force as part of the United Kingdom's commitment to N.A.T.O." The types listed were "Canberra light bombers, Valiant medium bombers, and Swift and Hunter fighter and reconnaissance aircraft." The aircraft would be delivered by June, 1955.

Hunting Survey Conference

THIRTY delegates, including 14 overseas representatives, met in London on June 19th at a conference of all the aerial survey companies associated within the Hunting Group. These Hunting survey companies are established right around the globe, and they operate 45 aircraft, including a B-17 bomber and several helicopters.

Film Shelved

ONE of several projected films by British Lion was to have been "Alcock and Brown"—a record of the pioneers' famous first direct Atlantic flight in 1919. Unfortunately, when the corporation became insolvent, the film had to be shelved. Shepperton studios are now run by the Government Film Finance Corporation, who are reported to be unable to put up the £200,000 required.

Heron Feathers

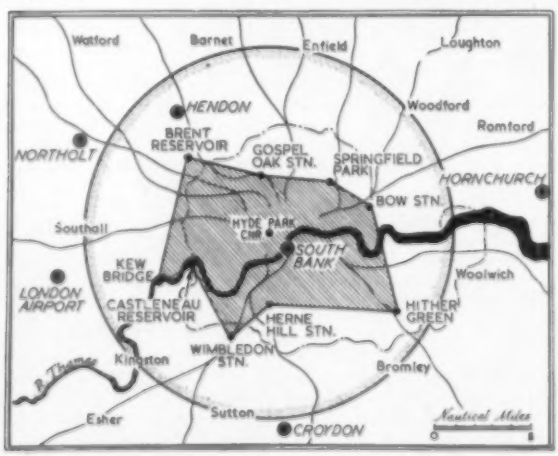
CONTRARY to information earlier reported, the de Havilland Aircraft company state that they have no plans for fitting any Herons with feathering airscrews; previously it was thought that a special machine for the Duke of Edinburgh—the order for which the company cannot confirm—would be so fitted.

At it Again!

QUOTING a Soviet Aviation Day article by Air Marshal N. Shriko, Moscow radio last week made claims to several "firsts," starting with the well-known assertion that Mozhaisky in 1882 made the first heavier-than-air flight. Others included the first outside loop, or bunt, by Nikolayevich in 1913; and "the first jet flight," by Bakhchivanzhi in 1942, in an aircraft built by the constructor Bolkhovitinov, with an engine designed by Doushkin. It was also claimed that in the last three years of the war the U.S.S.R. produced 40,000 aircraft a year, and that since the war speeds of 1,000 km/hr (621.37 m.p.h.) had been reached and were now being exceeded. Another of the air marshal's claims was that Russia's length of internal air routes exceeded that of the United States.

Jet-Shy Brazilian Pilots?

FOR the time being Brazil is to buy no more jet aircraft for her air force. The Air Ministry is seeking instead to obtain a grant for more heavy transport aircraft. The Air Minister, Nero Moura, said recently that the problem of the Brazilian Air Force is not one of equipment but of personnel. Some 85 per cent of candidates failed to make the grade because of their intellectual level, though less than 30 per cent failed medically. Airline piloting was a counter-attraction.



CITY LIMITS: This "Flight" sketch shows the extent of the area of Central London over which helicopters may not fly except at such a height that, in the event of engine failure, a safe landing can be made outside the area. The exception is the "helicopter highway" formed by the River Thames, along which helicopters may be flown as low as 500ft. In the outer section of the 10-mile circle, restrictions have been relaxed *(see page 818).*

Trans-Pacific B-47s

THREE U.S.A.F. B-47s were due to leave March A.F.B., California, last weekend on a non-stop flight of about 15 hours to Yokota, near Tokyo, a distance of 6,700 miles. They were to be air-refuelled by KC-97 tankers.

Rockets from Canberras

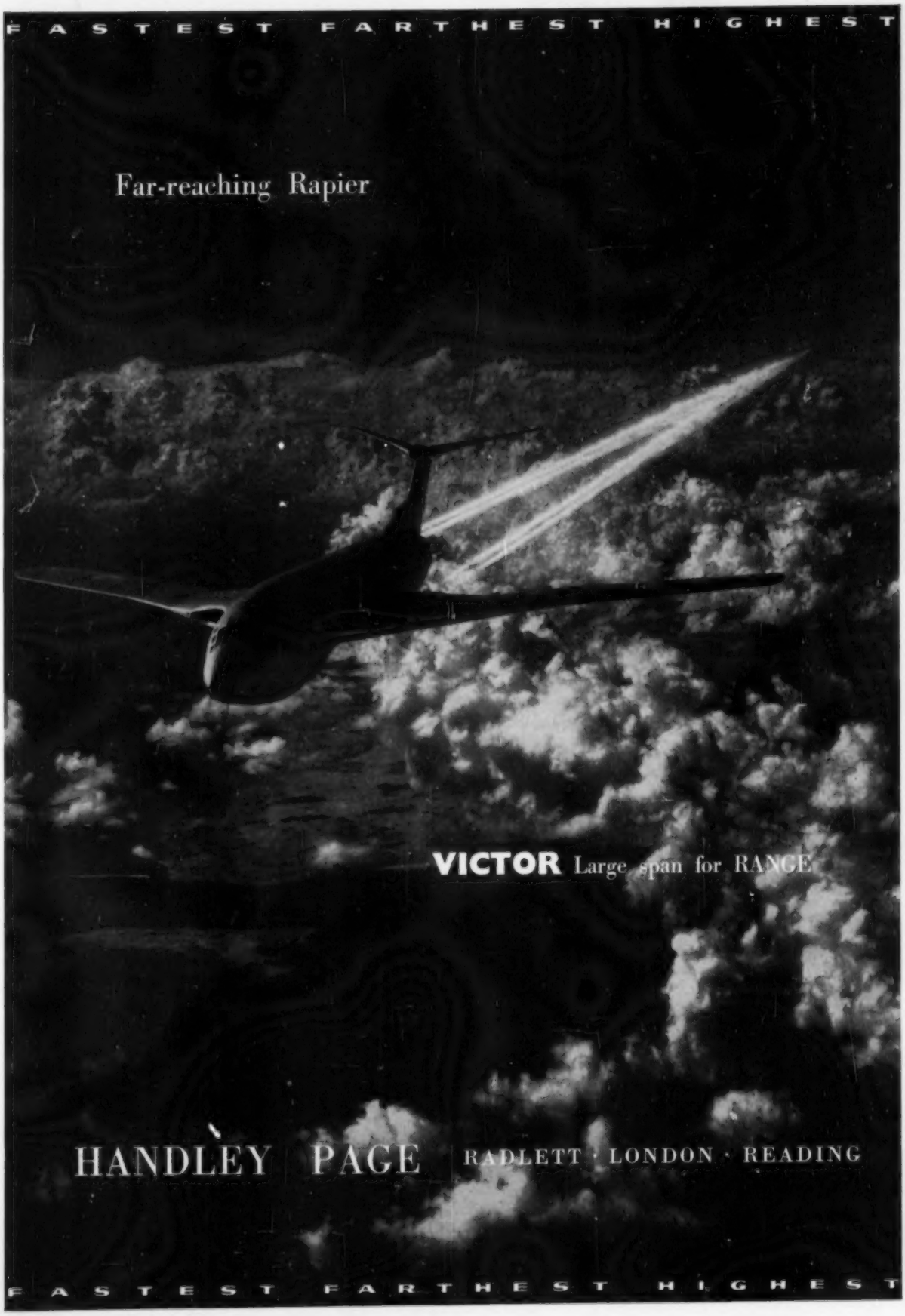
SPEAKING at a meeting of the Royal Society in Canberra last week, Dr. D. F. Martyn, F.R.S., said that preparations were being made at Woomera for the launching of small high-altitude research rockets from Canberra aircraft. Dr. Martyn is chief scientific officer of the Radio Research Board of the Commonwealth Scientific and Industrial Research Organization.

F.B.I. Scholarships

A RECENTLY published booklet *F.B.I. Overseas Scholarships*, describes recent progress in the Federation of British Industries scheme for bringing to Britain for practical training young graduate engineers from the less developed countries abroad. Since the scheme began in 1950, a total of 52 scholars have been accepted for training, but within the next two years the Federation hopes that the annual number of awards made will rise to approximately 120. Included in the booklet (copies of which are available free from the Federation at 21 Tothill Street, London, S.W.1) is a list of the 150 firms which have accepted or agreed to accept F.B.I. scholars: among these companies are Blackburn and General Aircraft and Fairey Aviation.

Helicopters in Canadian Surveys

THIS year the Geological Survey of Canada is placing 86 parties in the field; the largest project will be a reconnaissance of 60,000 square miles in the central part of Keewatin District, Northern Territories. As in the 1952 survey of the southern part of Keewatin District, much use will be made of helicopters, while a fuel cache will also be laid in preparation for similar project in 1955. Rotating-wing aircraft are to be tried in two other projects this year: in the Coquitlam area of British Columbia one will be used for geological traverses in mountainous terrain, and two parties will make joint use of another for transportation in an investigation of the mineral resources in Cape Breton Island.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DEPOTS THROUGHOUT THE WORLD

Tib.267

THE NATIONAL AIR RACES

Events of Friday and Saturday at Coventry

"FLIGHT" Photographs

THERE were some lengthy countenances around Baginton early on Friday, June 18th; and they did not shorten as the ambient gloom failed to show signs of dispersing. But the racing went off—and the flying display went on—to plan, and the few hundreds of spectators were in some measure consoled. As for Saturday—the Big Day—it broke unpromisingly, but blossomed into sheer perfection, with the glare of a hot sun screened by just sufficient clouds, and a breeze to help in tanning more than 20,000 brows.

Royal Aero Club Trophy Race

The line-up on Friday for the Royal Aero Club Trophy Race was a colourful one, only slightly smaller in numbers than the previously published list. The Dutch pilot Uges in the Sokol M.1D had withdrawn, while de Luigi had failed to arrive from Switzerland with his Nardi FN.305: the only foreign entry remaining was that of Captain Christie, the Norwegian S.A.S. pilot, in the Globe Swift. Fred Dunkerley, whose choice lay between his new white Sparrowjet, his Gemini and the Mew Gull entered by D. J. Adie, had both Sparrowjet and Gemini on the line, leaving his final decision until the last moment.

The weather was dull and depressing as the first machine took off—F/L. D'Arcy's silver Messenger, soon followed after the appropriate intervals by the other aircraft. Only surprise was the apparent ease with which the Globe Swift, which began rolling together with Parker's Proctor after 11 minutes, 20 seconds, pulled away from it immediately after take-off. Handicap time for Ron Paine's Speed Six was 28 minutes, 10 seconds; six minutes later, the Sparrowjet (which Dunkerley had elected to fly) appeared to be having starting trouble.

The scheduled take-off time arrived, and passed. After a quarter of an hour, it became sadly obvious to observers that this year's Nationals would not have the promised début of the Sparrowjet, most radical new idea in the post-war British racing scene. From a disappointed Dunkerley we later heard the cause; a blockage in the compressed-air lead from the starting bottles (for the race, two bottles had been adapted instead of the previously used one).

Reports from the turning points, meanwhile, indicated no big surprise along the 183-mile course. Tim Wood's Messenger, No. 2 away, had passed D'Arcy; the Globe Swift's initial swiftness had not been maintained, for Parker was now ahead; while the two most promising pieces of gap-closing had been performed by Knox (Proctor 3) and Nat Somers in his Gemini.

About 70 minutes after the start of the race, the leading machines could just be seen approaching. Cream wings identified Knox's Proctor coming in low, while a second Proctor ("Sailor" Parker's) was seen descending behind the trees just short of the aerodrome. Past the winning line, almost on the deck, sped No. 70, half the aerodrome ahead of Somers's Gemini; then Bowles, and Miss Leaf's Hawk Major, almost together; after them — regularly spaced — Dray, Bennett, "Buster" Paine, Blamire, Marler and Fillingham.

A closed-up group lead by Ron Paine's Speed Six appeared next, with Lovett-Campbell, Wood, Hillwood and McIntosh; followed by D'Arcy, Jemmett and, after an interval, the Globe Swift, fast-looking, white and low. Subsequent news located the missing machines: in addition to Parker (who had run out of fuel and made an emergency landing in a potato field), Rush and Lyle had force-landed at Tempsford and Bourn. Forward to the King's Cup went the first 15 to complete the course: as Ron Paine was

National prizewinners: (Top) Tim Wood receives the King's Cup. On the left he is seen at the finishing line. (Below, left to right) Maj. Lovett-Campbell (Norton-Griffiths Trophy), Miss Leaf (Air League Challenge Cup), and Nat Somers (Kemsley Challenge Trophy).

In the foreground, the triumphant Messengers of Wood and D'Arcy: behind, the D.H.31 and part of the public enclosure's vast crowd.

Dunkerley's misfortune (left); as Philip Mayne's flag comes down, attempts to start the Miles Sparrowjet continue. The new machine, however, was unable to take part in the race. (Right) Winner of the Royal Aero Club Trophy, T. G. Knox with his Proctor 3.

THE NATIONAL AIR RACES . . .

disqualified for turning inside one of the corners, D'Arcy moved up to 15th place.

The King's Cup

After the overnight re-handicapping on the basis of Friday's race times, D'Arcy's Messenger G-AKBM was again the first machine to take off, in brilliant weather, for Saturday's King's Cup Race. A second Messenger, that of Tim Wood, followed closely. Miss Leaf in the Hawk Major preceded the simultaneous get-away of Fillingham's Chipmunk and Blamire's soft-gold Gemini; half a minute later, Bowles' equally attractive Gemini —white-topped, red-cowled—sparkled into the air.

The six Proctors, separated by a total of two minutes, were next to go. Ten seconds behind McIntosh (and 6 minutes, 42 seconds after D'Arcy), Lovett-Campbell in the Nighthawk took off, and then the two Messengers were approaching to complete their first 17-mile lap, bank steeply round the pylon, and disappear towards Hunningham again. Marler in the Falcon Six and Nat Somers in his light-blue Gemini were the last two to become airborne.

There was little change in position at the end of the first lap, except that "Buster" Paine's red Proctor was now ahead of Bennett and Hillwood. Fillingham was keeping just ahead of Blamire, and Somers' Gemini had crept past Marler's Falcon Six.

Coming round for the second time, Tim Wood in No. 38 was seen to have taken over the lead, about a quarter of a mile ahead of D'Arcy. Bowles seemed to be closing the gap behind Blamire, as the former's red nacelles caught the sun in a steep bank round the pylon and away over the line of parked visiting aircraft. After Knox's green-nosed Proctor came the close-packed gaggle of four further Proctors, black, scarlet, grey and blue in turn, and then McIntosh's cream machine, flown very low. No change in position this lap.

It was on the third lap that the field really began to close up. Behind Wood, D'Arcy and Miss Leaf, distant dots could be seen round the Brandon turn. As the Proctors came round, it could be seen that Lovett-Campbell in the cream Nighthawk had passed McIntosh and Hillwood: Somers was coming up right behind Hillwood's Proctor.

As the leading aircraft approached on the final run-in from Brandon, the brightly coloured Proctor-dots were seen banking round this final turn. Although catching up fast, the speedier machines were unable to affect the positions of the first three home. First, Tim Wood's cream Messenger, a comfortable winner. Second, D'Arcy in his silver Messenger, still very low, with the Hawk Major on its tail.

In a close group—finishing within four seconds of each other —came four different types. Snatching the lead from Fillingham's Chipmunk, Somers' Gipsy Major Gemini 3 passed the line one second ahead. Close after the Chipmunk in almost a dead-heat were Dray's black Proctor and Bowles' red, white and silver Gemini 1A. "Buster" Paine, Knox and Blamire were followed by Bennett's Proctor and the Nighthawk, and finally Marler's Falcon Six and the Proctors of McIntosh and Hillwood. The time interval between first and last aircraft had been 1 minute, 33 seconds.

The National Air Race awards were made by Lord Brabazon of Tara, president of the Royal Aero Club, shortly after the afternoon's flying display. The first, second and third awards for the King's Cup were made to Wood, D'Arcy and Miss Leaf, who also received the special award of the Air League Challenge Cup as the first-placed woman pilot of this year's King's Cup Race.

The Royal Aero Club International Trophy, together with £100, was won outright by T. G. Knox, and cash prizes were presented to the remainder of the first ten to finish. The £25 prize for the first-placed foreign entry was returned as a donation towards the next international race by Captain Christie. Also awarded on a speed basis from the results of Friday's race was the Kemsley Trophy (for aircraft weighing 1,000 to 1,750 kg); first, J. N. Somers, second, Geoffrey Marler, and third, W/C. McIntosh: and the Norton-Griffiths Challenge Trophy (for aircraft weighing less than 1,000 kg); first, Major Lovett-Campbell, second, W. P. I. Fillingham, and third, Captain Christie.

NATIONAL AIR RACES RESULTS

Royal Aero Club International Trophy				King's Cup			
Pl.	Pilot, Aircraft and Engine	H'cap Time m. s.	Av'age Speed (m.p.h.)	Pl.	H'cap Time m. s.	Av'age Speed (m.p.h.)
1	T. G. Knox (Proctor 3, Gipsy Queen 2)	09 50	148	9	04 27	147.5
2	J. N. Somers (Gemini 3, 2 Gipsy Major 1C)	21 10	174.5	4	08 28	174
3	W. P. Bowles (Gemini 1A, 2 Cirrus Minor 2)	09 00	145	7	03 41	144.5
4	Miss F. M. Leaf (Hawk Major, Gipsy Major 1)	05 20	138	3	02 13	138
5	D. F. Dray (Proctor 3, Gipsy Queen 2)	13 50	154.5	6	05 32	154.5
6	D. J. Bennett (Proctor 5, Gipsy Queen 2)	13 50	154	11	05 32	152.5
7	A. S. K. Paine (Proctor 1, Gipsy Queen 2)	14 05	154	8	05 38	154.5
8	P. Blamire (Gemini 1A, 2 Cirrus Minor 2)	07 50	141.5	10	03 10	141
9	G. C. Marler (Falcon Six, Gipsy Six 1)	21 20	170.5	13	08 16	168.5
10	W. P. I. Fillingham (Chipmunk, Gipsy Major 10C)	08 20	141.5	5	03 10	142
11	Maj. P. V. Lovett-Campbell (Nighthawk, Gipsy Six 2)	17 05	158.5	12	06 42	159.5
12	H. Wood (Messenger 2A, Cirrus Major 3)	00 55	128.5	1	00 23	133
13	P. Hillwood (Proctor 1, Gipsy Queen 2)	14 15	151.5	15	05 38	151
14	W/C. R. H. McIntosh (Proctor 1, Gipsy Queen 2)	17 05	157.5	14	06 31	156.5
15	F/L. M. A. D'Arcy (Messenger 2A, Cirrus Major 3)	00 00	125.5	2	00 00	129
16	D. C. Jemmett (Hawk Tr. 3, Gipsy Major 1C)	00 55	126			
17	Capt. J. H. Christie (Globe Swift, Continental C-125)	11 20	141			
—	G. R. I. Parker (Proctor 5, Gipsy Queen 2)	Force landed				
—	W. W. Lyle (Proctor 1, Gipsy Queen 2)	Force landed				
—	S/L. J. Rush (Falcon Six, Gipsy Six 1)	Retired				
—	R. R. Paine (Hawk Speed Six, Gipsy Six H.C.)	Disqualified				

Fifty Years Fly-past

The sporting aeronauts of yesteryear (or was Lord Brabazon the only one there?) might well have felt a salty trickle down a sunburned cheek as the 28,000cu ft craft of Cardington's G. E. Long soared aloft, free as a bird, towards the friendly clouds. And not only the veterans went starry-eyed at the sight, for we saw a youthful would-be Throttle-Bender gazing enthralled as the dear, queer shape was borne across the dappled fields, and slowly sank behind a verdant ridge.

The noisy part of the proceedings broke on the ear with faint mutterings of frail engines, as one by one "The Pioneers" whirred out from the wings, breasted the breeze, and wobbled into the air above the daisies, the cabbage butterflies, and the sear-brown trails of the Sparrowjet. First came the Blériot XI of 1909, then the Deperdussin, and last—flying very strongly—the Blackburn Monoplane. As this stout-hearted pensioner swung into a turn, the breeze took charge and sent it whizzing down the field at a spanking 80 m.p.h.

From the '14-'18 war came the olive-drab Sopwith Pup and the silver Bristol F.2B Fighter, the Brisfit's gunner traversing his

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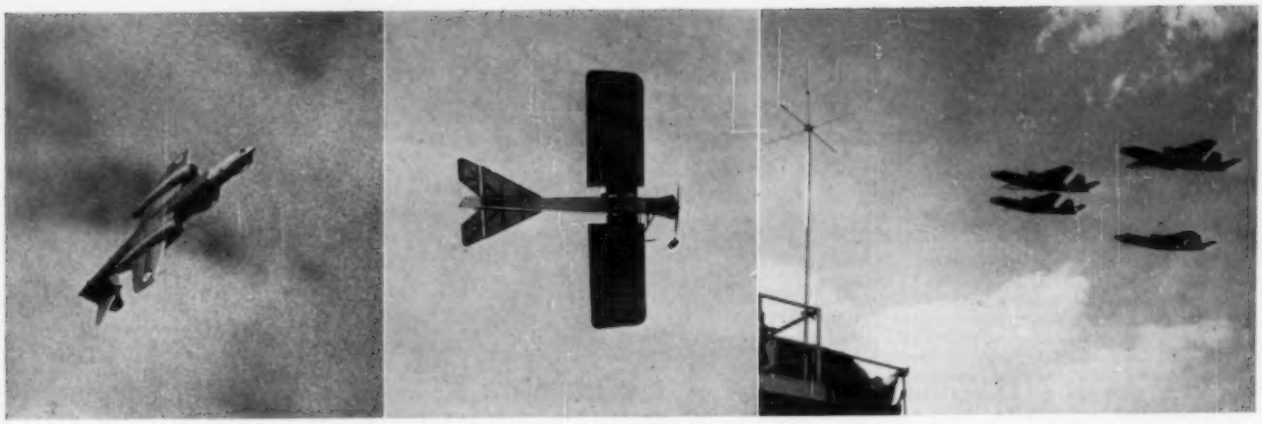


Three star-turns: The Armstrong Whitworth prone-pilot Meteor, the Blackburn monoplane (Gnôme) of 1912, and the Canberra formation

THE NATIONAL AIR RACES . . .

Scarff-mounted Lewis with flaunting defiance as the two machines dog-fought through the tight, clean manoeuvres on which their fame is founded.

"The Development of the Light Aeroplane, 1919-1938" was illustrated by remarkably well-preserved specimens of the Hawker Cygnet, D.H. Moth, Hawker Tom-Tit, Spartan Arrow, D.H. Leopard Moth, Blackburn B.2, Avro Club Cadet, D.H. Moth Major, Percival Gull Six, Miles Hawk Trainer, Miles Whitney Straight, D.H. Moth Minor and Tipsy 1—each flying vigorously in its fashion. (The sharply nose-down attitude of the Club Cadet, when flying all-out, was especially remarked upon.) Neville Duke, on the Tom-Tit, rendered an aerobatic encore of singular grace, though the little blue biplane often jibbed in surprise on hitting its own slipstream—like the dachshund round the tree.

Hawker's famous Hart "MR" (which actually dates from the early 1930s) led the tableau "The Second World War," and was followed by Fairey Swordfish NF389 (the last of 2,391 built), the Gloster Gladiator G-AMRK, the Hurricane *Last of the Many*, A. Cdre. A. H. Wheeler's Spitfire V AB910, and a Bomber Command Lancaster which, descending to very intimate levels indeed, was seen to be carrying a mock-up of the Wallis "weapon" for its part in the film *The Dam Busters*.

The film star having bowed out, the Saro Skeeter and Bristol 171 helicopters swung low before the crowds like the sweet chariots they are, and Ranald Porteous put the pretty little red-and-white Auster Aiglet Trainer through its enchanting paces.

Epitomizing the "Jet Age," there thundered on to the scene a Meteor 7, in charge of F/L. R. W. Jordan, D.F.C. Being a C.F.S. instructor, the flight lieutenant flew with donnish perfection, though one supposes that he *might* muff a manoeuvre if he tried very hard.

To the writer's own mind one of the most completely satisfying events of the day was the demonstration by four English Electric Canberras of No. 10 Squadron, Bomber Command, which bore down upon the field in box formation (a vic of three blue and one—silver-finished—in the box) at some 520 m.p.h. As they roared and rumbled round the enclosures, one reflected that no machine in the Canberra's class could possibly have paralleled this performance, every phase of which bespoke docility of control, reserve of power, and—certainly not least—the skill of S/L. D. R. Howard, D.F.C., A.F.C., F/L. Collins, Master Pilot Brown and F/L. Briggs.

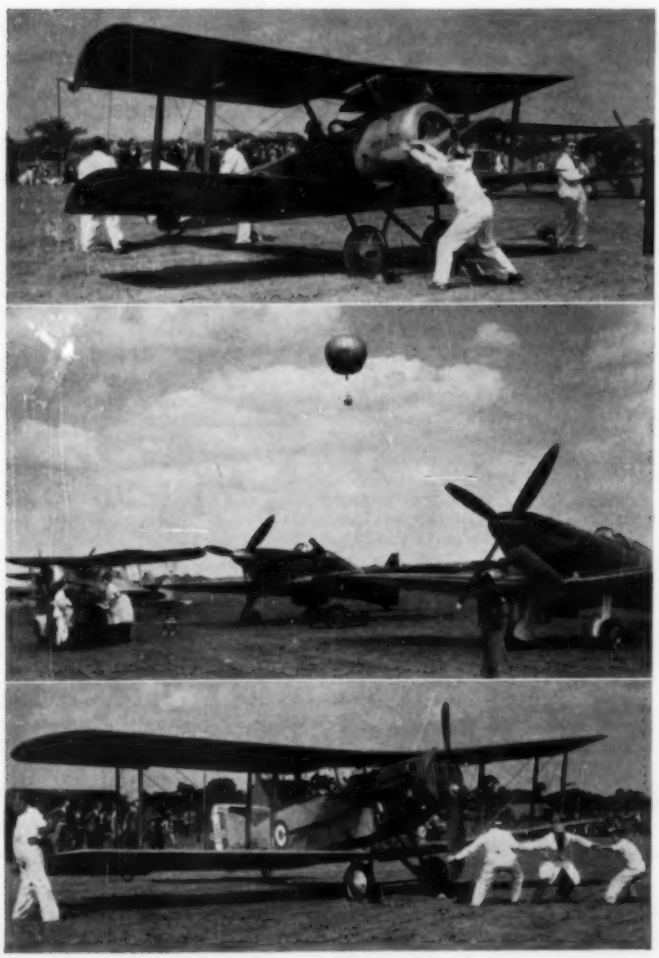
This well-merited eulogy of the Canberras must in no way detract from the lustre of the performance of the Canadair-built Sabres of the R.C.A.F., individually by F/L. E. D. Kelly and in concert by F/L. D. Wingate, F/O. M. Gillies, F/O. N. Ronaason and F/O. J. Kerr. Their shows were in every sense terrific—and how the crowds goggled at the writhing smoke trails as they struck across the fields like fearsome serpents!

At Sabre-like speed there came upon the scene a lone Sea Hawk, occupied by yet another Kelly—not, be it said, from the Isle of Man, but from Brawdy, Wales, in the person of our old friend, Lt. J. Kelly, R.N., of 898 Squadron, F.A.A. Eloquent of his skill, and of the Sea Hawk's powers were very tight turns, very late pull-outs, and very precise rolls.

The surprise items (in anticipation of which commentator Charles Gardner had everyone on tenterhooks) materialized as dashing appearances by the Armstrong Whitworth prone-pilot Meteor, the Armstrong Siddeley Sapphire-Lancastrian, and re-heat Sapphire-Canberra. The Meteor's performance appeared to be quite uninhibited by its nasal transformation, and Eric Franklin and Bill Else—respectively prone and seated—deserve a word of special praise for a show which was a delight in itself—quite apart from the Meteor's technical interest.

The promised French ultra-lights were nowhere to be seen, but France made her mark with the Hurel-Dubois H.D.31—now with its wing-tips cocked up at a saucy angle. The phenomenal short-field performance of this potential Dak-replacement is well-known to readers, and as a display-piece it is equally out of the ordinary.

The official proceedings of the day terminated with the prize-giving, but joy-riding continued—if not until dusk, then for as long as the present writer lingered on the scene.



Out of retirement: (Top) The Sopwith Pup; (centre) Mr. Long's balloon, the Gladiator, Hurricane and Spitfire AB910 (TE357, from Middle Wallop also demonstrated); (bottom) the Bristol Fighter.

CIVIL AVIATION

"Flight" photograph

THINGS TO COME: The plans for B.E.A.'s scheduled service with S-55s between the South Bank and London Airport next year are reported on this page. Here, a Naval S-55 from Westlands is seen landing at the South Bank site on June 17th.

HELICOPTERS OVER LONDON

ACTION last week by the Minister of Transport and Civil Aviation, Mr. A. T. Lennox-Boyd, resulted in a sudden focusing of interest on the future growth of civil helicopter services —in particular, those into the centre of London. The relaxation of flight restrictions for helicopters flying over London, immediate use of the South Bank site for landings and take-offs, and plans for a scheduled B.E.A. service to London Airport next year were all part of the encouraging news which rapidly came to the notice of most Londoners just over a week ago.

The inauguration of B.E.A.'s scheduled passenger service with Bristol Sycamore 3As from Southampton (Eastleigh) to London Airport and Northolt took place on Tuesday, June 15th. In the early hours of the following morning, in the House of Commons, Mr. John Profumo, Parliamentary Secretary to the M.T.C.A., replied to an adjournment debate opened by Mr. Norman Dodds. In this reply, Mr. Profumo announced that his Ministry were authorizing B.E.A. to purchase immediately two Westland-built Sikorsky S.55s: as soon as these machines obtained a British C. of A., an experimental scheduled passenger service between London Airport and the city centre would be started.

Mr. Profumo added that, in order to facilitate helicopter movement into and across London, the Minister intended forthwith to exempt helicopters from the minimum altitude rules when flying over part of the London area, subject to certain conditions. Turning to the problem of a landing site, Mr. Profumo said that, with the support and co-operation of the L.C.C., a site on the South Bank would be made available for any helicopter that wished to come into central London in the immediate future. Only 24 hours' notice would be required. The location and characteristics of a permanent rotorstation for London, however, could not yet be decided.

The relaxation of the flight requirements applies only to flights within a radius of ten nautical miles of Hyde Park Corner, and outside the central area shown shaded on the map on page 814. In this central area, the previous regulations remain (i.e., machines must be flown at a height enabling them to land *outside the area* in the event of engine failure, and in any case not less than 1,000ft) except for the line of the River Thames—above which the minimum height is now 500ft—and when landing at or taking off from the South Bank site. In the outer part of the circle, helicopters must be flown so that, in the event of engine failure, they can alight without danger to persons, property, buildings, or vessels, and in any case at not less than 1,000ft.

The S.55s to be used on the scheduled B.E.A. service mentioned by Mr. Profumo are to be fitted with pontoon floats and, according to Lord Douglas, will take 22 minutes for the 18½-mile journey between the South Bank and London Airport. The route would follow the river between Waterloo and Putney, and the machines would carry six passengers plus full baggage allowances; the single fare would probably be £1 10s 0d.

Advantage was quickly taken of the new regulations. A conference between M.T.C.A. officials and helicopter pilots concerning the use of the South Bank site was held on Wednesday afternoon. On Thursday morning a smart orange-and-white-checked control van was parked between the Waterloo air terminal and the river, next to a roped-off area of concrete. A brace of S.51s buzzed up and down the river at 500 newly-legal feet as the morning swarms of office-bound humans emerged from Waterloo. And at 10 o'clock, the first landing was made by Westland's G-AKTW, flown by John Fay, and chartered by the *Evening News*.

A Naval-coloured S.55 Whirlwind from Yeovil was the next to get into the act, carrying Harold Penrose and two packets of Westland publicity brochures, and flown by Derek Colvin. The *Evening Standard's* red S.51 then dropped in—quite gently, of course—in the hands of G. L. Jacques, to be followed at 11 o'clock by that of Autair, Ltd., flown by John Crewdson and carrying the duly-accredited representative of the *Star*.

First representative of an aviation journal to sample the "new deal" for South Bank rotorcraft in action was, we modestly record, the writer of this page. An invitation from Mr. Ron Myhill (managing director of Autair's parent company, R.M. Overseas Motors) to make a 15-minute demonstration flight with Capt. Crewdson along the river was readily accepted, and almost immediately we found ourselves looking through a window into the long-suffering eyes of a sixth floor inhabitant of County Hall, before tilting across to the river and climbing up over Westminster Bridge. The flight emphasized the impression that the broad river is an excellent helicopter highway for the forthcoming services, and that the South Bank site is indeed a most suitably located and clearly visible space. When the initial publicity ballyhoo of the popular press has died down, and the number of South Bank helicopter landings approaches that of any of the three largest American cities up to now, there is no doubt that Mr. Lennox-Boyd's decision will be seen to have given a valuable and needed boost to the previously slow operational development of British helicopters.

Watching the B.E.A. demonstration flights in the Bristol 171, G-AMWG, which ended the first day of the embryo rotorstation's activity was Mr. Carl Agar, vice-president operations of Okanagan Helicopters, the well-known Canadian company. An even more significant interest in the new landing site is that of Sabena, whose first flight from Brussels to London is scheduled for tomorrow, June 26th.

BREVITIES

THE eighth Southern Pacific Air Transport Council is meeting in Melbourne on Monday next, June 28th, for about five days. The United Kingdom delegation is being led by Mr. E. A. Armstrong, C.B., C.B.E.

* * *

The Indian Government is negotiating a bilateral air agreement with Irak, to enable Air India International to develop its Far Eastern services to Middle East countries via Baghdad.

* * *

Hedley S. Crabtree and Co., Ltd., of 9 Ovington Gardens, London, S.W.3, announce that, following the completion of a technical investigation contract, they have been appointed retained consultant engineers to Scandinavian Airlines System.

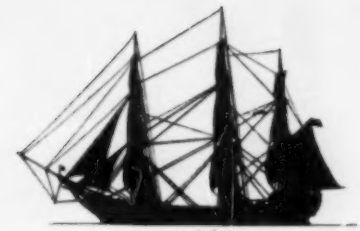
* * *

The services of Pakistan International Airlines were inaugurated recently by Mr. Mohammed Ali, the Prime Minister. The Government-subsidised company operates three Super Constellations between Karachi in west Pakistan and Dacca in east Pakistan, separated by 1,200 miles of Indian territory.

* * *

Recently published and privately circulated by K.L.M. is a book entitled *We Flew to Christchurch—the Story of a Memorable Long-distance Flight*. It is a 92-page illustrated account of the journey of the K.L.M. DC-6A which won the transport section of the England to New Zealand Air Race last October; and is written by Henrik Scholte, secretary for special services to the K.L.M. general operations group.

Air Power at Sea



H.M.S. THESEUS

In the records of the names of British warships H.M.S. *Theseus* appears three times: first as a third-rate commissioned in 1786, most recently as the light fleet carrier *Theseus* of 13,350 tons launched in 1944. Commissioned in peace, this ship yet has a history of action as one of Britain's principal naval units engaged in the Korean war. In the support of ground formations her aircraft, including squadrons of Fairey Fireflies, flew 3,446 operational sorties and made 4,594 deck landings, maintaining a standard of efficiency in carrier operation seldom equalled. Her reconnaissance aircraft (mainly Fairey Fireflies) covered 23,492,730 square miles.

H.M.S. *Theseus* represents a class of carrier which will, in the near future, operate Gannets, the Royal Navy's latest and most powerful anti-submarine aircraft designed and built by Fairey.

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MILITARY AIRCRAFT 1954

By H. F. KING, M.B.E.

THE military aircraft now in being, or in immediate prospect, form a bewildering collection; and by reason of vast and intricate problems of design and operation, all aspects of their development show a consistency of inconsistence unparalleled in any other field of arms. These pages immediately disclose, for instance, the astonishing vagaries of aerodynamic design. Structures, though less diverse in principle, vary widely in detail treatment, while weapons range from anti-personnel darts to thermo-nuclear bombs of titanic power. In the choice of power plants a fair degree of unanimity is observed; but even here there is restlessness.

If one near-certainty emerges, it is that the manned aeroplane will not quickly be supplanted by pilotless machines; and it is clear that the guided missile, while a valued accession to the air armoury, holds no immediate promise of superseding the piloted fighter.

The high-altitude jet bomber, it will be seen, is posing an increasingly difficult interception problem, and fighter design is being channelled into widely diverging courses in an attempt to counter the threat. "Tactical" bombers are still much in demand, though the fields and methods of their employment are not, perhaps, clearly foreseen. Deep incursions are already being made by the helicopter into the time-honoured territory of fixed-wing aircraft, notably for anti-submarine work and the assault of land objectives, while into the transport field will soon be appearing some strategic aircraft of very great consequence to the future development of military, and perhaps civil, operations.

It is not without significance that a naval fighter until recently held the world's speed record; and, as for naval striking power, it need only be remarked that America is developing a carrier-borne machine of much higher performance and with far greater carrying capacity than present-day land-based tactical bombers. The trainer picture is becoming somewhat less confused as requirements are more clearly defined.

This appraisal is wholly technical, and nowhere touches upon such abstractions as orders of battle, standards of training and preparedness. It is common knowledge, however, that both America and Russia have far greater numbers of modern jet aircraft in service than has Great Britain, while in the intercepter class it must be recognized that only a most gratifying influx of Canadair-built Sabres has raised our own nation to something like parity with Sweden.

The merits of British military aircraft are everywhere acclaimed; yet the security of our future insistently demands more penetrative thought and more resolute action on the part of our designers and operational staffs. The pace quickens from week to week, and the most efficient aircraft here reviewed are but steps along a rising, perilous road leading no one knows where. Only a few years have passed since the very idea of a supersonic bomber was commonly ridiculed, though the possibility of supersonic fighters may have been grudgingly conceded. Now, genuine faster-than-sound intercepters are entering service, and bombers of like performance, if not immediately in view, are surely coming, just as manned fighters capable of a Mach number of 2 or even 3 are coming, though vast problems continue to supervene.

Military Aircraft 1954

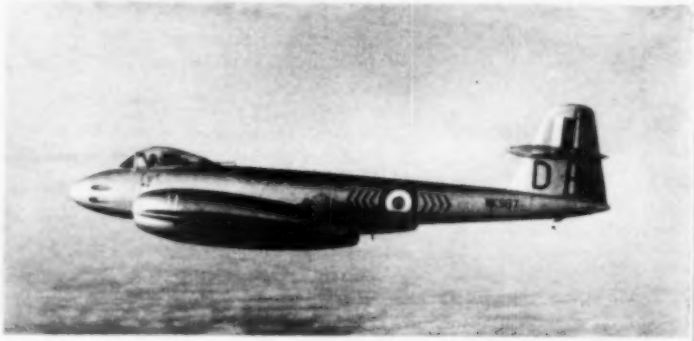
FIGHTERS

THE cardinal fighter requirements of speed, climb, manœuvrability and firepower remain; yet these pages will show that the aircraft themselves are getting smaller—and larger; lighter—and heavier; less conventional—and more orthodox; more complex—and simpler. And though the fighter is still the chosen instrument for destroying the enemy's potential in the air, the huge increments in the bomber's speed and over-target height have multiplied the problems of interception to a perplexing degree.

As ever, the single-seater preponderates in the fighter squadrons, in the experimental shops and on the drawing-boards; and its usefulness having been proved in darkness and foul weather, it bids fair to consolidate, and even to improve, its present status. But where long endurance is mandatory, a second crewman will still find employment.

Hawker Hunter F.1 (Rolls-Royce Avon).

Gloster Meteor F.8 (two Rolls-Royce Derwent 8).



While in one direction single-seaters are becoming larger and heavier (because of the radar and extra fuel for all-weather interception, and armament to improve the chances of a kill), a precisely opposite departure has lately been initiated by a British company, and is being followed to some extent abroad. The "light fighter," to which this tendency is directed, is by no means a novel concept (as witness the He 162 Volksjager of 1945), and its limitations are self-evident; but its proponents are neither so fanatical nor so gullible as to believe that the tiny machines they envisage could wholly, or largely, supplant the more elaborate designs—even could they be employed in the numbers made possible by their relatively low cost. Though early projects, in this country at least, have received little or no official support, the knowledge that development is going forward as a private venture is welcome reassurance in these times of uncertainty and disappointment.

Another departure is the V.T.O. (vertical take-off) fighter, the first of which was the rocket-propelled Bachem Natter of the late war. The operational advantages promised by this sort of fighter are of undeniable significance—not for shipboard service alone, and not necessarily with airscrew propulsion.

One other launching device meriting comment is the jettisonable rocket-propelled trolley as used with the S.E. Baroudeur; but that aircraft being primarily intended for ground attack, its appurtenances are dealt with under the appropriate heading. The Baroudeur lands on a skid undercarriage and thus follows the principles initiated in the Me 163.

One general observation on current fighter design is called for: that wing loadings have risen so high, and powers of manœuvre are so restricted in consequence, that many new fighters may often fail to bring armament to bear on contemporary bombers. The reluctance of British designers to join in the general unleashing of fighter loadings in pursuit of sheer speed is thus to be applauded, though the fear remains that vast technical effort may often be nullified by blindness to an elementary precept—that a fighter must be able to outmanœuvre its quarry. Such primitive expedients as the Sabre's 6-3 leading edge (added to the wing at a time of near-crisis to improve manœuvrability at height) may not always be feasible.

There is some possibility that the next class of fighter to make its entry into an already seething arena might be of the "flying fortress," or *multiplace de combat* type, dragged once more from limbo as was the light fighter. Such machines might bear some resemblance to jet bombers. They would have long endurance, might carry their own long-range radar, and having by this means picked up the approaching enemy some hundreds of miles from the threatened target, would launch their missiles in a running fight, as destroyers might harry capital ships.

Vickers-Supermarine Swift F.4 (Rolls-Royce Avon).

Fighters • SINGLE-SEAT LAND-BASED

GREAT BRITAIN

de Havilland Venom F.B.1. This more powerful, thin-winged development of the Vampire serves the R.A.F. as a standard fighter/bomber. While the makers themselves recognize that it is no match for some more modern designs in all-out level speed at low altitude, they do maintain (and justly so, having regard to results obtained in air exercises) that in terms of general performance and manœuvrability at very high altitude, and in its ability to reach those altitudes in a short time, the Venom is outstanding. It was the first British fighter to have wing-tip tanks, which can be jettisoned if necessary, although the wing is stressed to provide full manœuvrability with the tanks filled, thus avoiding the necessity of jettisoning them (if still containing fuel) before joining combat.

The Venom F.B.1 and F.B.4 are powered with a D.H. Ghost and are armed with four 20 mm Hispano guns. Span is 41ft 8in.

English Electric F.23. It has been officially stated that an aircraft capable of supersonic speed in level flight will soon be flying in Great Britain, and that development would be hastened by an order for 20 pre-production examples. The new fighter is believed to be designated English Electric F.23.

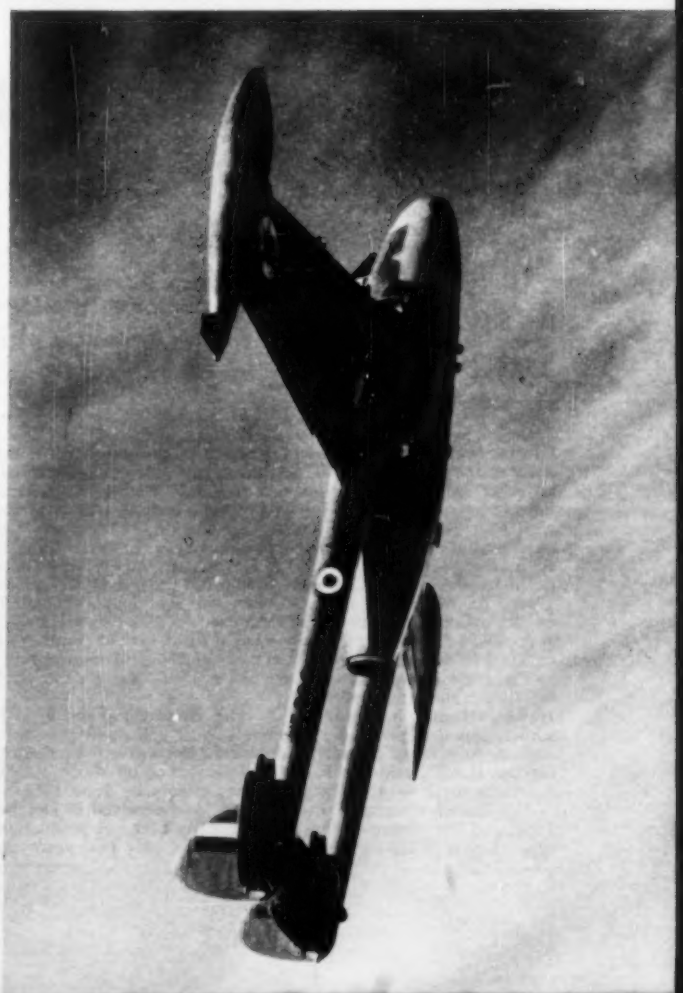
Folland Gnat. In the absence of specific information on this light fighter, recourse must be had to a paper wherein the designer discusses a hypothetical machine of the same character. This has a gross weight of 5,500 lb and it is concluded that, for the same outlay of man-hours, five times as many of these small machines could be built as of large "conventional" fighters weighing 16,500 lb. Useful loads are foreseen as some 42 per cent and 33 per cent respectively, because (it is considered) structure, engine and miscellaneous services could all be lighter, without sacrifice of performance or strength.

It is recognized that there is a limit below which reduction of equipment must not fall. Follands have in mind two 20 mm or 30 mm, or four 0.5in guns with "reasonable ammunition," adequate wide-range radio facilities, "some form of navigational aid," and possibly provision for radar gun ranging as an overload.

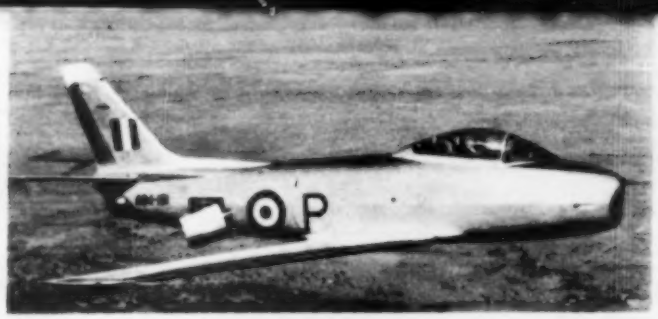
Early this year the Bristol company announced that, anticipating "a considerable demand" for light, medium-thrust turbojets for light fighters and jet trainers, they were developing an axial unit known as the Orpheus, and that one of these would be installed in the Gnat. "Medium thrust" might apply to a 4,000-6,000 lb unit.

The Gnat is believed to have a shoulder wing of about 20ft span and an undercarriage which retracts into the fuselage.

de Havilland Venom F.B.1 (D.H. Ghost).



Canadair Sabre 5 (Avro Canada Orenda).

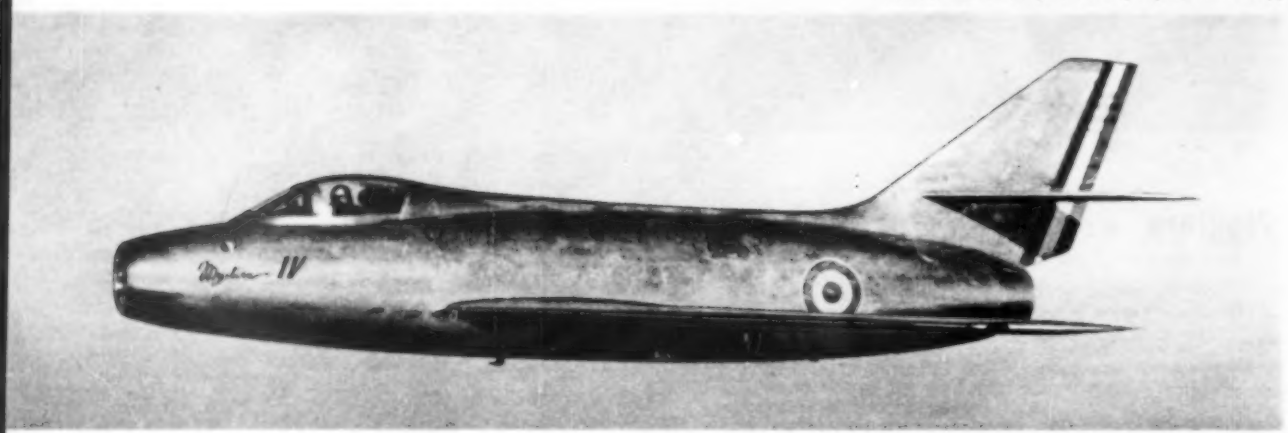


Commonwealth Sabre CA-27 (Rolls-Royce Avon).

S.O.6026 Espadon (Hispano-Suiza Nene and S.E.P.R. 251 Rocket).

S.O.9000 Trident (S.E.P.R. rocket and two Turboméca Marboré II).

Marcel Dassault Mystère IVA (Hispano-Suiza Tay).



Military Aircraft 1954

Fighters • SINGLE-SEAT LAND-BASED

Gloster Meteor F.8. The Meteor F.8—a progressive development of the Gloster F.9/40, first flown in 1943—far outnumbers all other machines in the service of R.A.F. Fighter Command. Powered with two Rolls-Royce Derwent turbojets, it is armed with four 20 mm Hispano guns, provided with 780 rounds of ammunition and a retractable gyro gunsight. In recent months Meteor 8s with a new type of rear-vision canopy have been delivered to squadrons. Gross weight is 15,675 lb, 17,250 lb, or 19,040 lb, depending upon whether the fuel load is 420, 595 or 795 gallons. Maximum speed at sea level is 585 m.p.h. and at 30,000ft, 550 m.p.h. Initially 6,950 ft/min, rate of climb drops to 3,000 ft/min at 30,000ft. Ceiling is 43,000ft, maximum range 950 nautical miles, and take-off run, at 15,675 lb, 1,450ft. Span is 37ft 2in and length 44ft 7in.

Hawker Hunter F.1 and F.2. The Hunter F.1 and F.2 are similar but are powered respectively with a Rolls-Royce Avon and an Armstrong Siddeley Sapphire. Both are in production for the R.A.F., and the F.1 is the subject of off-shore NATO contracts totalling 450 machines, for delivery by June 1956.

The British "instruction to proceed" was received in October 1950, and the contract followed six months later. A production-type Hunter F.1 was flown in May 1953—only two years and seven months after the order was first intimated to the makers.

Although a new design, the Hunter is the outcome of lengthy development, stemming from Hawker's first jet-fighter, the P.1040. This 1947 straight-wing machine was later adapted as a flying test-bed for the Armstrong Siddeley Snarler rocket and redesignated P.1072. The next main development was the P.1052, with a swept wing but retaining the straight tail and split-jet system of the P.1040 and P.1072. The P.1081 had a normal jet-orifice and a swept tail, and this design—the last to be powered by a Nene—eventually led to the Avon-powered P.1067, or Hunter. Considerably larger than its precursors, the Hunter has finer lines and an undercarriage of wider track.

To a slightly non-standard Hunter F.1, with a pointed fuselage-nose and faired screen, fell the long-sought honour of wresting the speed record from America after it had been held there for six years. For this venture, the Avon was fitted with an afterburner. The record (later captured successively by the Vickers-Supermarine Swift, Douglas Skyray and North American F-100) was homologated at 727.6 m.p.h. and was, of course, set up at very low level.

Armament of the Hunter has not been officially disclosed, but undoubtedly conforms to Britain's new scheme of 4 × 30 mm Aden guns, with radar-ranging sight. For quick, easy, re-arming and servicing, the guns are installed as a "pack." Production machines incorporate new-pattern dive brakes. Span is 33ft 8in, length 45ft 3in.

Vickers-Supermarine Swift F.1-F.4. The first modern swept-wing fighter of British design and construction to pass into R.A.F. service, the Swift has a development history which begins with the piston-engined Spiteful of 1945. The Spiteful was a Spitfire development, with a laminar-flow wing and raised cockpit; of the few dozen built, one achieved a speed of 494 m.p.h.

S.F.E.C.M.A.S. 1402 Gerfaut (S.N.E.C.M.A. Atar 101C).

Mig-15 (RD-45F).

in level flight. With a new, laminar-flow fuselage housing a Rolls-Royce Nene turbojet the Spiteful became the 590 m.p.h. Attacker, and this was followed in 1948 by the swept-wing Type 510—considered by the makers to have been the first of the Swifts. In July 1950 a second prototype 510 was flown and, with the substitution of a nosewheel undercarriage, this became the 535. The first "production-prototype" Swift—the 541—in which a Rolls-Royce Avon axial turbojet replaced the centrifugal Nene, flew in August 1952. The Mk 1 has a fixed tailplane and no afterburner. The Mk 2 is similar, but has four guns; the Mk 3 has an afterburner and two guns; and the Mk 4—now in quantity production — has an afterburner, a movable tailplane and four guns. The Mk 4 was first flown on May 27th, 1953.

The only figures which can usefully be quoted for the Swift's performance are the low-level speed of 735.7 m.p.h., confirmed as a world record last year, and an average of 669 m.p.h. between London and Paris.

Of armament a trifle more can be said, for the Swift is the first fighter officially admitted to carry the new 30 mm Aden gun. Official reference to this weapon was made by the Minister of Supply in March this year. "With this powerful cannon," he said, "the Swift is capable of bringing to bear eight times more high explosive than was possible with earlier types of guns. Its revolutionary design gives the Aden cannon about twice the rate of fire of the 20 mm Hispano gun, which has been our standard fighter weapon since 1941. Trials have proved that the Aden, with advanced type of gun-sights and quick-acting fuse, is capable of inflicting devastating damage. The introduction of the Swift, with its superb flying performance and terrific fire power, is a milestone in the progress of Britain's air defence."

Span of the Swift F.4 is 32ft 4in, length 41ft 6in.

AUSTRALIA

Commonwealth Avon-Sabre (CA-27). This is a version of the North American F-86 Sabre, built by the Commonwealth Aircraft Corporation Pty., Ltd. Though differing little in appearance from the F-86F, substitution of a Rolls-Royce RA. 7 for the General Electric J47, and replacement of the six 0.5in guns by two 30 mm Adens, necessitated so many changes that only about 40 per cent of the original fuselage structure could be retained. As the Avon consumes some 25 per cent more air than the J47, the size of the intake duct had to be correspondingly increased, and the problems which then arose were simply solved by splitting the front fuselage horizontally and inserting a "wedge" of structure. As the Avon does not support the tail-pipe cantilever-fashion, the rear fuselage had to be redesigned. Excellent speed and climb performance has been demonstrated and a radius of action of about 500 miles should be attainable.

CANADA

Canadair Orenda-Sabre (F-86EO, or Sabre F.5). For some months past aircraft of this type have been leaving the Canadair production lines for delivery to the R.C.A.F. and R.A.F. The "O" in the designation denotes an F-86E airframe adapted for the Avro Canada Orenda turbojet. The 6-3 leading edge (see F-86F) is embodied, and armament is six 0.5in guns.

FRANCE

Marcel Dassault M.D.450 Ouragan. The Ouragan was designed late in 1947 and first flew early in 1949. It is serving with the French and Indian air forces, is Nene-powered, has four 20 mm guns and weighs about 11,600 lb all-up. It is being supplanted in production by the Mystère.

Marcel Dassault M.D.452 Mystère II. This swept-wing Ouragan development dates from 1951 and is being produced, as the Mystère IIC, with the SNECMA Atar 101. It is armed with two 30 mm guns, with radar-ranging sight. Top speed is about 670 m.p.h.

Marcel Dassault Mystère IVA. Now in production for the French Air Force and for NATO (225 aircraft), this mark of Mystère has thinner, more sharply swept wings than the II. Initially the Hispano-Suiza Tay was installed, but the more powerful Verdon is specified for later machines. All-round performance is considerably in excess of that of the Mystère II.

Marcel Dassault Mystère IVB. Standard power plant of this variant is the Hispano-Suiza-built Avon RA. 7R, and with this unit a Mach number of 1 has been attained in level flight. The two 30 mm guns can be supplemented by a retractable rocket-launcher.

Marcel Dassault Mystère XXB. An even more sharply swept, thin-wing Avon-powered Mystère development, designed for a maximum level speed considerably in excess of Mach 1.

Marcel Dassault Light Fighter. Possibly designated M.D.550, this is intended to have an Armstrong Siddeley Viper turbojet, for which Marcel Dassault hold a manufacturing licence.

S.N.C.A.S.E. Durandal. A light, delta-wing, supersonic interceptor, the first prototype of which should fly next year; this machine has a nose intake and a fuselage of inordinate length relative to the wing span. A "spine" fairing, as on the Hunter and Mystère, is a feature.

S.N.C.A.S.E. Mistral. A Nene-powered version of the de Havilland Vampire, developed in France, this fighter flies at a weight of 10,900 lb, has a top speed of nearly 570 m.p.h., and climbs to 39,350ft in about 11 min. (Another Nene-Vampire development is a standard R.A.A.F. fighter.)

S.F.E.C.M.A.S. 1402 Gerfaut. A prototype, Atar-powered intercepter, the Gerfaut has an extremely thin delta wing, much of which is thought to be of high-tensile steel. A characteristic

Saab-29 (J-29) (D.H. Ghost).

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feature, well-shown in the photograph, is the "superstructure" above the fuselage proper. The span is reported as 21ft 4in.

S.N.C.A.S.O. 9000 Trident. Prototype of a light intercepter, the Trident has a straight wing of low aspect ratio and very thin section, carrying a Turboméca Marboré II turbojet of 880 lb static thrust at each tip. In the rear of the perfectly streamlined fuselage is provision for a S.E.P.R. rocket, with the thrust of which, it is hoped, a Mach number of 1.6 will eventually be achieved. "Sandwich" construction is extensively used, and the nose section, including the cockpit, is jettisonable in flight. The narrow-track undercarriage has high-pressure tyres and retracts entirely into the fuselage. The elevators have negative dihedral.

S.N.C.A.S.O. 6026 Espadon. A late development of the Espadon series, the 6026 has a S.E.P.R. 251 rocket in addition to the Hispano Suiza Nene turbojet. Though no longer regarded as a potential operational fighter, this machine has achieved supersonic speed in level flight and has proved invaluable in the development of the power plant for the Trident.

RUSSIA

Mig-15 and 15 *bis*. The Mig-15 *bis*, an example of which has been thoroughly examined, is similar to the Mig-15 but incorporates a number of detail improvements and is powered with a VK-1 turbojet of 5,950 lb thrust instead of the less powerful RD-45F. Both units are of Rolls-Royce Nene type. Flying weight of the 15 *bis* is 11,085 lb and the armament is two 23 mm and one 37 mm guns. Neither the 15 or 15 *bis* is capable of supersonic speed. Span is 33ft.

Soviet Shoulder-wing Single-seater. Often referred to as the Lavochkin La-17, this machine has been positively identified, but since a photograph was published in our preceding "Military Aircraft" number (April 4th, 1952) no additional information has been forthcoming.

New-type Soviet Fighter. There is reason to suppose that the fighters which escorted the very large bomber heading the May Day fly-past over Moscow this year were of a new type, possibly larger than the Mig-15 and doubtless of higher performance.

SWEDEN

Saab-29 (J-29). Though it has not been disclosed how many of these "flying barrel" fighters have been built, it is known that most of Sweden's 30 day-fighter squadrons, as well as attack and reconnaissance units, are equipped with the type. In May a J-29 set a new 500-km closed-circuit record of 607 m.p.h., and the pilot was confident that had not ground mist intervened his average would have been 620 m.p.h.

The makers of the J-29 are understandably proud that this is the most modern jet fighter of Western European origin in large-scale service and production. It has a limiting Mach number of about 0.86 in level flight at all heights, is an excellent gun platform, and has an operational ceiling of about 45,000ft; it attains 40,000ft in about 10 min, depending on load. Limiting speed with wing tanks is 430 kt, rate of roll is high and turning radius small. A Swedish-built Ghost turbojet is fitted and the armament is four 20 mm guns. Span is 36ft 1in, length 33ft 2½in.

U.S.A.

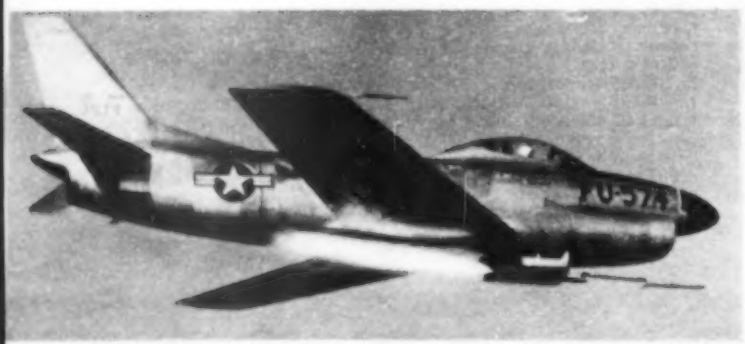
Convair YF-102. The first prototype of this supersonic, delta-wing fighter for the U.S.A.F. was flown on October 24th, 1953, but was subsequently written off in an emergency landing at Muroc. The second example flew on January 11th this year. With all-weather equipment, the YF-102 is believed to approach 30,000 lb in weight. The present power plant is a Pratt and Whitney J57-P-11 with afterburner, but the Wright J67 (up to 25,000 lb thrust with reheat) is proposed. Primary armament of production F-102s will be air-to-air missiles—possibly Hughes F-98 Falcons.

Lockheed F-104. Classed as a "day superiority fighter," this straight-wing machine will have a downward-ejection seat. The power plant is a Wright J65.

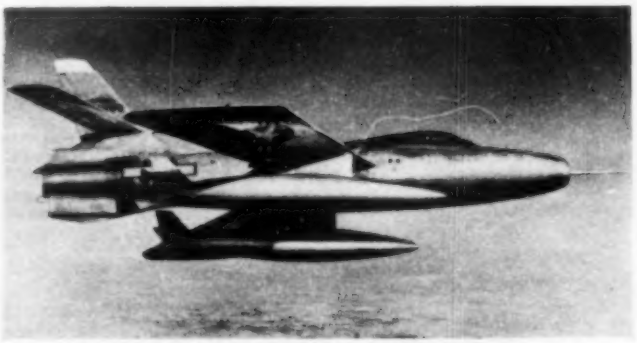
McDonnell F-101A. Development from the XF-88 of 1949, this ultra-long-range fighter, with the Pratt and Whitney J57-P-13 turbojet, is in quantity production.

North American F-86A Sabre. Large numbers of these pioneer fighters have been reconditioned, fitted with an up-rated J47 turbojet, and new radar and armament systems.

North American F-86D Sabre. Differing very extensively from other Sabres, this all-weather version carries interception radar in the nose, thereby necessitating a "beard" intake. Associated with the radar is a Hughes intercepter fire-control system, developed to include an electro-mechanical coupling with the Lear lightweight automatic pilot and thus to provide full "lock-on" facilities. The pilot's task is principally that of monitoring the equipment (by means of a large tube-face in the centre of his instrument panel), and, being too preoccupied to keep watch on the behaviour of the power plant, he is relieved of the task by a complex control system for the J47-GE-17 unit, with afterburner. Armament is twenty-four 2.75in Mighty Mouse unguided rockets, carried in a launcher which is extended hydraulically by the fire-control system at the appropriate range. Their speed relative to the aircraft on leaving the launcher is about 100 m.p.h., and when passing the nose, about 500 m.p.h. Armament and other



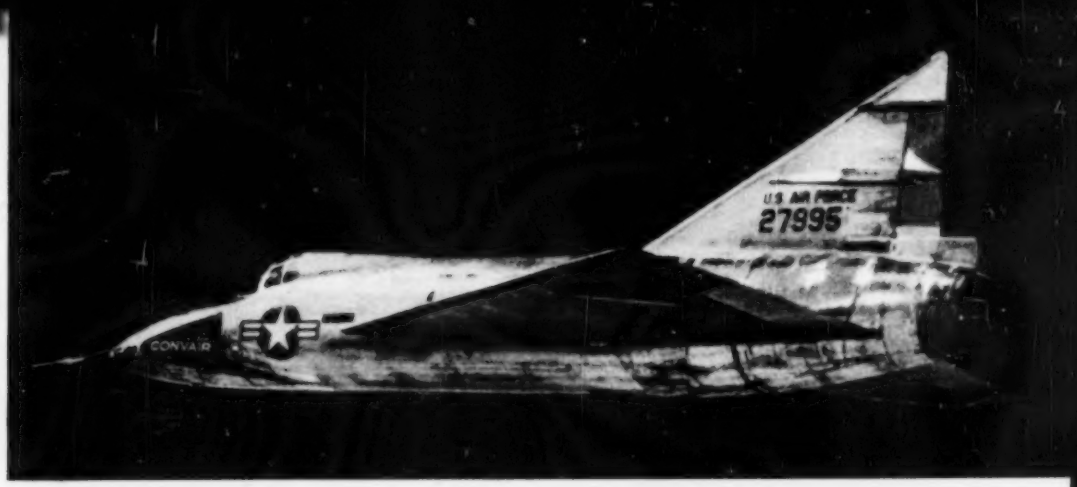
North American F-86D Sabre (General Electric J47-GE-17).



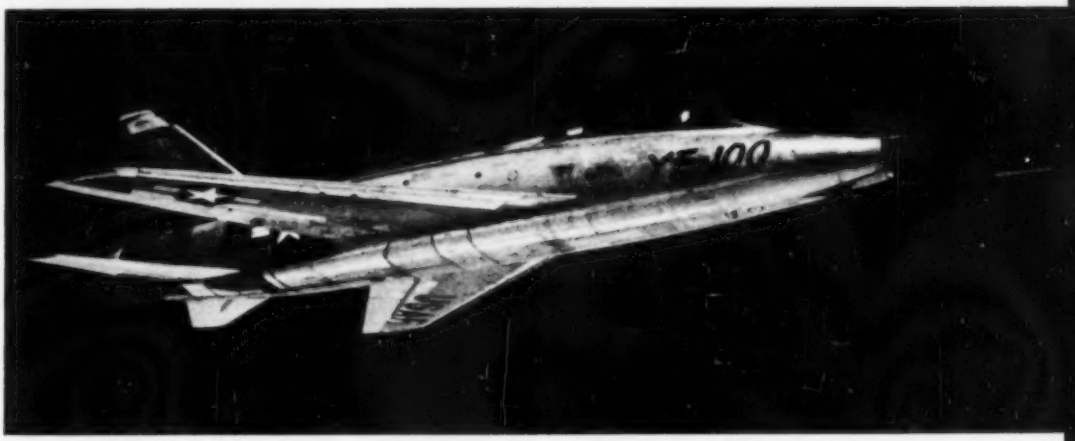
Republic XF-91 (General Electric J47 and Reaction Motors rocket).

Republic F-84G Thunderjet (Allison J35-A-29).

Republic F-84F Thunderstreak (Wright J65).



Convair YF-102 (Pratt and Whitney J57-P-11).



North American YF-100 (Pratt and Whitney J57-7).

systems of the F-86D were described in considerable detail in *Flight* of January 15th, and it was then remarked that the rockets must follow a path governed solely by the direction in which the fighter is flying at the moment of release, and not by the relative wind, which varies with the angle of attack and yaw.

North-American F-86E Sabre. Probably the best known of all the Sabres, this variant introduced the "all-flying" tail. The first full description—with a detailed sectional drawing—appeared in *Flight* of January 30th, 1953.

North American F-86F Sabre. This Sabre is basically redesigned, has a lighter structure and is powered with the General Electric J47-GE-27 of 5,800/6,000 lb thrust. Modifications have been introduced to permit freer employment in the fighter/bomber role and further reference to the aircraft will be found under "Ground Attack." The F-86F incorporates as standard the "6-3" leading edge (i.e., the chord is increased by 6in at the root and 3in at the tip), which permits maximum rate of turn without buffeting and thus avoiding the risk of pulling out the leading-edge slats which the new leading edge displaces.

North American F-86H Sabre. Another revised version of the Sabre, larger, heavier and stronger, and far more powerful than its forerunners. The turbojet is a General Electric J73-GE-3 with a dry static thrust rating of 9,200 lb. New wing construction is employed and other changes include a high tailplane, without dihedral, "clamshell" canopy of larger dimensions, a new ejector seat, and improved suspension of external stores.

North American F-86K Sabre. This version of the F-86D is to be built in Italy under the M.S.A. off-shore programme. The Hughes fire-control system will be replaced by simple A.I. radar, and the specified armament is four 20 mm guns.

North American F-100A Super Sabre. One of the most notable of all present-day single-seat fighters, the F-100 is a private venture, powered with a Pratt and Whitney J57-7 split-compressor turbojet. Wing sweep is 45 deg, and although dimensions—especially of the fuselage—are much greater than those of the F-86, a family resemblance is perpetuated. Take-off wing loading is probably about 85 lb/sq ft (no standard type of F-86 exceeds 75 lb/sq ft), and the retention of leading-edge slats is not altogether surprising. Apparently there are no flaps, and the only controllable surfaces on the wing are probably two-piece ailerons, set well inboard. A flat plate is hinged under the leading edge to form an air brake, and its action on landing is supplemented by a tail ribbon parachute. Titanium is used extensively, and the very thin wing being near-solid, the main fuel load is carried in the fuselage.

Service ceiling of the F-100A is "above 50,000ft," combat radius "more than 500 miles," and, as for speed, it is only necessary to recall that it was an F-100A which established the present world speed record of 754.98 m.p.h. The fastest of two passes over a 15 km course was made at 767.76 m.p.h. Air temperature was 87 deg and the runs were made at height of under 100ft. Span, 36ft; length, 45ft; height, 14ft.

Republic F-84G Thunderjet. This last development of the F-84, which passed out of production last year, has an automatic pilot and is powered with an Allison J35-A-29 of 5,600 lb thrust. Radius of action is 850 miles with two external fuel tanks, and 1,000 miles with four external tanks, but can be immensely extended by flight refuelling.

Republic F-84F Thunderstreak. Though alphabetically preceding the F-84G, this development (which passed into volume production last year), is a far more modern aircraft, having a 40 deg sweep on the slatted wing and on the horizontal tail surfaces, and being powered with the Wright J65 (Armstrong Siddeley Sapphire) turbojet of 7,200 lb thrust. Extensive use is made of large forgings, and the undercarriage is of unusually wide track. Armament remains six 0.5in guns and provision is made for flight refuelling. Span is 33ft 6in, length 43ft 4in.

Republic XF-91. This experimental turbojet-*cum*-rocket intercepter exceeded the speed of sound in late 1952, and subsequently it was announced that experience gained with the aircraft would be utilized "in future production." The XF-91 has a sharply swept, variable-incidence wing with inverse taper, and this last feature, in conjunction with leading-edge slats, is claimed to make possible lower flying speeds than are attainable by any other jet fighter. A tandem-wheel main undercarriage is another unorthodox feature. The power plants are a General Electric J47, with afterburner, and a Reaction Motors rocket of 6,000 lb.

Republic F-103. A very advanced fighter, stated to have a long fuselage, with small delta wings well aft. Apparently the basic power plant is a Wright J67, but for extra speed the air flow can be ducted around it and passed straight through the reheat tailpipe to form, in effect, a ramjet.

Republic F-105. A supersonic fighter/bomber, reported to have an Allison J71-A-7 turbojet.

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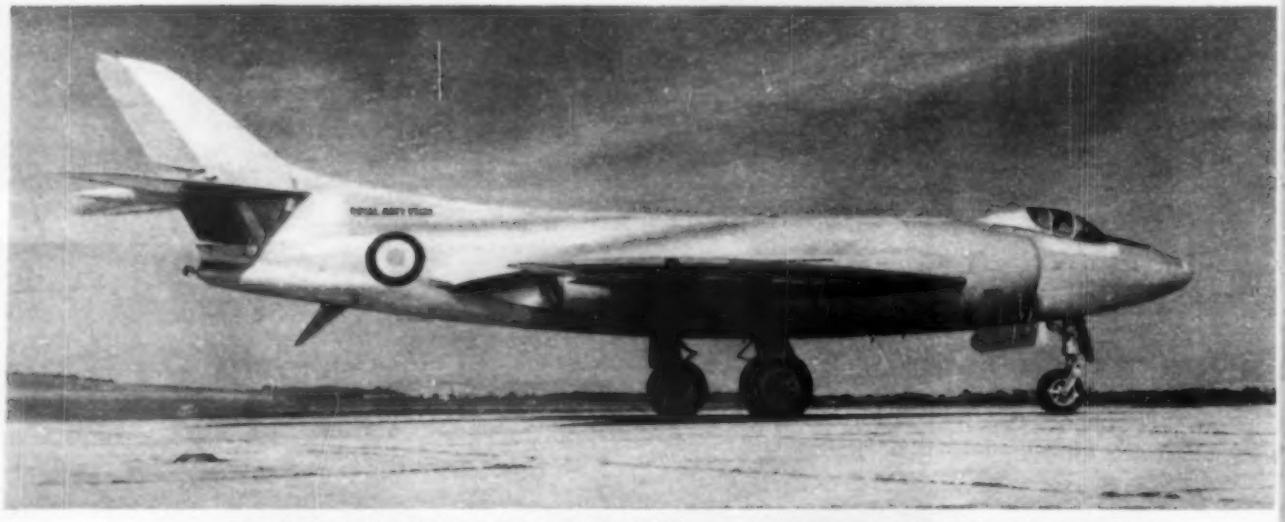


(Top left) Hawker Sea Hawk F.1 (Rolls-Royce Nene). (Above) Vickers-Supermarine Type 525 (two Rolls-Royce Avon).

GREAT BRITAIN

Hawker Sea Hawk F.1. Standard single-seat fighter of the Fleet Air Arm, the Sea Hawk F.1 is also the subject of a $13 m NATO off-shore contract. Its Rolls-Royce Nene has wing-root intakes and split outlets, and armament is four 20 mm guns. The Sea Hawk is authoritatively stated to be "not nearly at the limit of Mach number development."

Vickers-Supermarine Attacker F.1, F.B.1 and 2. The Attacker F.1 (Rolls-Royce Nene 3) was the original production version; the F.B.1 is a fighter/bomber; the F.B.2 has a Nene 102 and other improvements. Armament is four 20 mm guns, speed at 30,000ft, 538 m.p.h., and time to 30,000ft, 6.66 min.

Vickers-Supermarine Type 508/529. The Type 508 straight-wing, twin-Avon naval fighter prototype dates from 1951, and the 529 is almost identical. A distinctive feature of both is a butterfly tail. The wing has "droop-snoot" leading edges. Armament is apparently four 30 mm guns.

Vickers-Supermarine Type 525. A derivative of the 508/529, the 525, which first flew in May this year, has swept wing and tail surfaces and is an interim development towards an even more advanced, single-seater for the Royal Navy.

U.S.A.

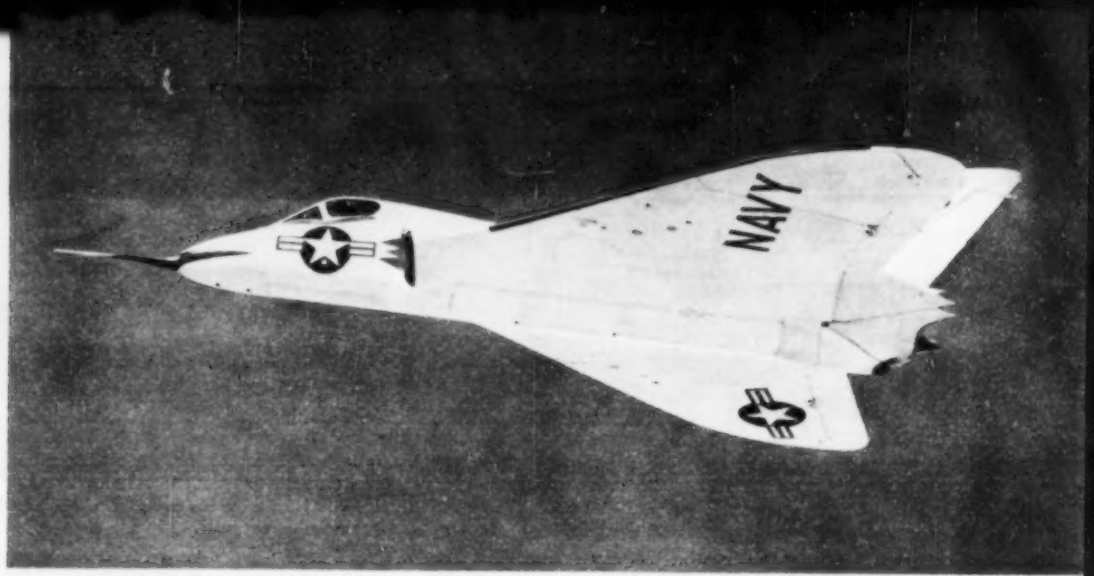
Chance Vought F7U-3 Cutlass. The F7U-3 is the principal version of the Cutlass tailless fighter, and is powered with two Westinghouse J46s, with afterburners. The hydraulic power control system is completely duplicated and the four 20 mm guns can be supplemented by a ventral pack of 2.75in rockets. Provision is also made for two rocket pods on wing pylons. The F7U-3M is a "missile launcher."

Chance Vought F8U. An order has been placed for this J57-powered fighter, which has a variable-incidence wing.

Convair XFY-1. Like the Lockheed XFV-1, this experimental vertical-take-off fighter for the U.S. Navy is designed to be capable of hovering flight, and is the forerunner of machines to be based on cargo vessels, troop transports, destroyers and aircraft carriers. The power plant is an Allison T40 turboprop driving contra-rotating Curtiss-Wright six-blade airscrews, the fixed "spinner" of which houses a parachute. The aircraft stands on its cruciform tail for take-off and landing, and the pilot's gimbal-mounted seat rocks through 45 deg for landing. The tail provides so stable a support that the XFY-1 is said to topple only at 26 deg off-centre, and should thus be able to remain erect in a 40-kt crosswind. With reduced load it could land with one-half of the turboprop inoperative. Though the machine is normally serviced in a vertical position, a rig is provided to "fork-lift" it into a horizontal attitude.

(Left) Lockheed XFV-1. (Right) Convair XFY-1. Both aircraft have an Allison twin turboprop.

Douglas F4D Skyray. The design of this very efficient fighter dates from 1945, when a U.S. Naval intelligence team came upon studies of Professor Lippisch, pioneer of the delta wing. Nevertheless, in the designer's own view the bat-like mainplane should be considered as a conventional wing of low aspect ratio. Short span results in a high rate of roll and, as the outer panels fold upwards, easy stowage aboard a carrier. Powered with a Westinghouse J40, with afterburner, a Skyray prototype established a speed record of 752.9 m.p.h. last year, production machines may have the Pratt and Whitney J57. On the occasion of the record, the Skyray took off at a weight of about 20,000 lb, and 20 min 25 sec later touched down at 16,550 lb, having used about 575 U.S. gallons of fuel.



Douglas F4D Skyray (Westinghouse J40).

Grumman F9F Panther. The early F9F-2 (Pratt and Whitney J42) was succeeded by the F9F-3 (Allison J33-A-8) and by the F9F-4 (Allison J33-A-16). The F9F-5 differs not only in engine (Pratt and Whitney J48-P-4) but in having a larger fuselage and redesigned tail. Built-in armament is four 20 mm guns.

Grumman F9F Cougar. The Cougar is a "swept" development of the Panther. The F9F-6 has a Pratt and Whitney J48-P-8, with afterburner, and the F9F-7 an Allison J33-A-16. The F9F-8 (J48 turbojet) is distinguished by various design refinements, including outer wings with leading edges cambered and extended forward. Extra fuel is carried, and permissible "g" for turning at height is twice that of earlier models.

Lockheed XFV-1. Like the Convair XFY-1 (with which it should be compared), this V.T.O. fighter for the U.S. Navy is powered by an Allison twin turboprop. The makers say that it will climb with such speed that within one minute it will disappear from the sight of an observer, and that it can "intercept the enemy at a speed of 500 m.p.h. in level flight." They add that it is built from the lightest material available for aircraft construction, "with weight-saving devices applied wherever possible"; yet, they admit, it weighs twice as much as the average fighter of World War II.

McDonnell F2H-2, -3 and -4 Banshee. These developments of the F2H-1 all have two Westinghouse J34s. The -2 has greater fuel capacity in the lengthened fuselage and tip tanks; the -2N is a night fighter with longer nose; and the -3 has an extra section of fuselage to accommodate even more tankage. Armament is four 20 mm guns. The -4 has Hughes fire-control.

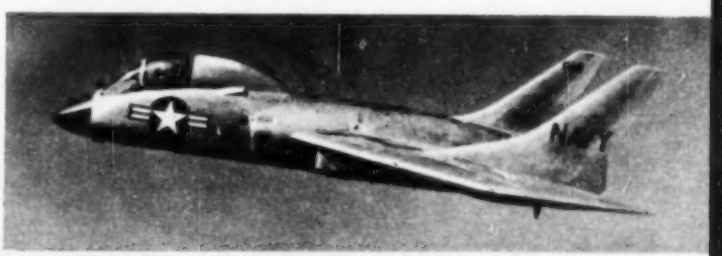
McDonnell F3H Demon. The Demon is a single-jet fighter in quantity production for the U.S. Navy; the first 60 have the Westinghouse J40 and the remainder are to be powered with the Allison J71. Ratio of fuselage length to span is unusually great (59ft : 36ft 4in), and it is known that the fuselage houses an exceptionally large fuel load. Like other modern single-seaters of the U.S. Navy, the Demon is being developed as an all-weather fighter, under the designations F3H-1N and -2N. The F3H-2M is officially described as a missile launcher.

North American FJ-2, -3 and -4 Fury. These aircraft are U.S. Navy developments of the F-86 Sabre, having various features to suit them for carrier operation. Thus, the nosewheel strut is designed so that the normal nose-up static attitude can be increased for catapulting. Armament is four 20 mm guns. The FJ-3 differs in being powered with a Wright J65.

The FJ-4 a thinner wing and a new tail.

North American FJ-2 Fury (Wright J65).

Grumman F9F-8 Cougar (Pratt and Whitney J48).



Chance Vought F7U-3 Cutlass (two Westinghouse J46).

McDonnell F3H-1N Demon (Westinghouse J40.)

Military Aircraft 1954

Convair XF2Y-1 Sea Dart (two Westinghouse J46).

Fighters · SINGLE-SEAT WATER-BASED

GREAT BRITAIN

Saunders-Roe Hydroski Fighter. Study of the SR/A.1 flying-boat fighter—the first jet-propelled water-based aircraft in the world—showed that a radical change in outlook was necessary if performance was to compete on equal terms with that of a land-based fighter. No concession could be made to hydrodynamic requirements, and the conventional hull, even with the most modern refinements, had to be discarded. Saunders-Roe, therefore, proceeded with the design of a water-based fighter in which hydroskis were used, but the project has received no official support.

U.S.A.

Convair XF2Y-1 Sea Dart. First flown in December 1952, the delta-wing, hydroski Sea Dart is powered with two Westinghouse J46 turbojets.

On take-off the Sea Dart begins to plane at about 10 kt, and rises on to the hump at 35-40 kt; take-off run is about 5,500ft and landing run 1,000ft. As the centre of gravity lies behind the skis, the machine assumes its own natural attitude during the run, a stable tripod being formed by the two main skis and the tail ski. Lateral stability and a flat wake are provided by the wing trailing edge.

The aircraft is designed to land not only on water but on snow, ice or sand—in fact, on anything except a concrete runway. The next prototype will have retracting pneumatic wheels for taxying and will manœuvre on the ground normally. Production aircraft will have an alternative form of air intake, designed to avoid water when the aircraft is taxying in rough conditions.

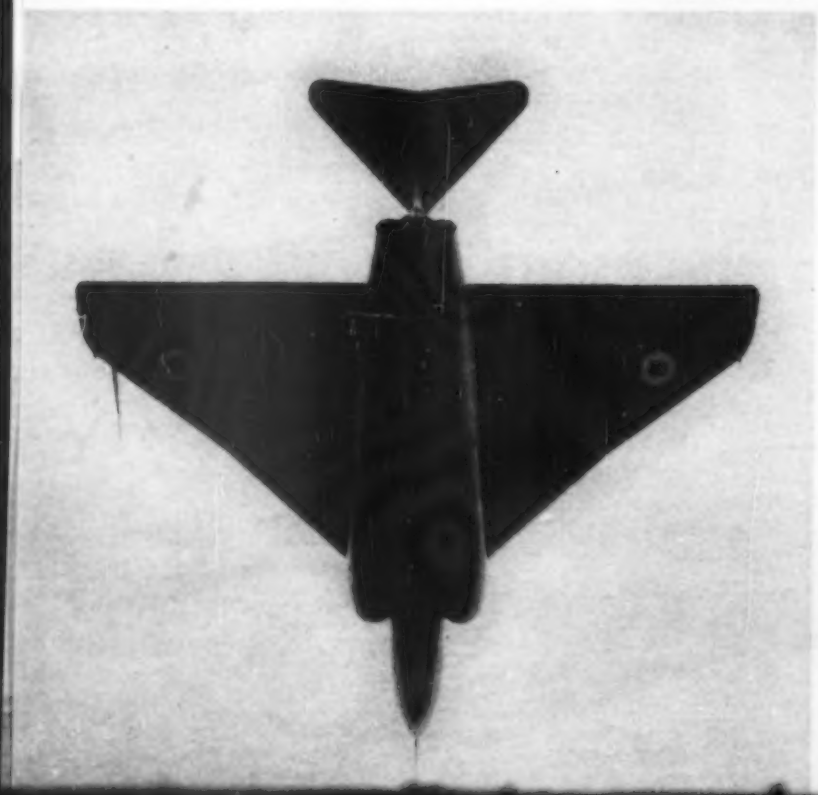
Fighters · MULTI-SEAT LAND-BASED

GREAT BRITAIN

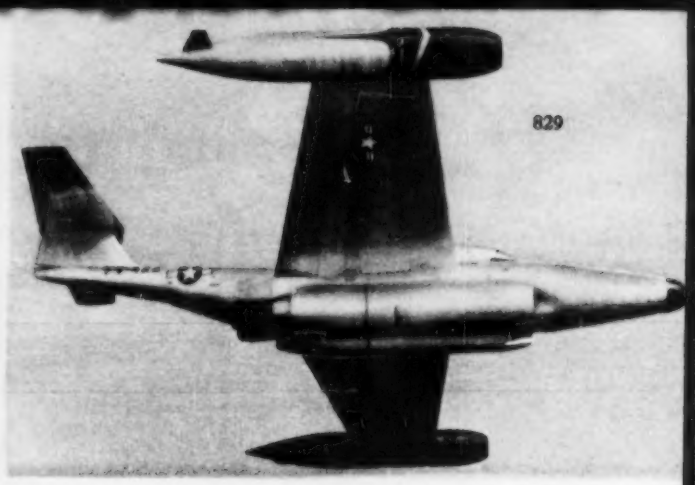
de Havilland Venom N.F.2 and 3. The Venom N.F.2 was the first night fighter variant of the basic Venom design to go into R.A.F. service, and the Mk 3 is a development—also in service—with "special combat equipment" and a redesigned tail. An export version of the Mk 2 for Sweden is designated N.F.51. All these machines are essentially similar, having a de Havilland Ghost turbojet and side-by-side seating for pilot and radar operator. Armament is four 20 mm guns. Although at one time it was expected that "N.F." Venoms would appear in service with afterburning, this has not yet been introduced, though it is evident that the gross weight is increasing as more equipment is demanded and that rate of climb (for which all Venoms are noted) must suffer accordingly. Like the single-seat Venoms, the night fighters are fully aerobatic with wing tanks fitted.

Gloster (Armstrong Whitworth) Meteor N.F.11, 12, 13, 14. All four of these variants of the Meteor night fighter—developed by Armstrong Whitworth—have long-span (43ft) wings, tandem-seated pilot and radar operator, and a characteristically lengthy radar nose. The four 20 mm guns are mounted outboard of the nacelles and under-wing tanks are often fitted in addition to the 180-gal ventral tank. The N.F.12 differs from the N.F.11 in having a revised fin, fairing into the characteristic intersection "bullet," and apparently new radar also; the N.F.13 has additional equipment, and on the N.F.14 a clear-vision canopy has been introduced. Meteor night fighters have been used for the experimental launching of British guided missiles, which, in some instances at least, are carried on the wing tips.

(Left) Gloster Javelin FAW.1 (two Armstrong Siddeley Sapphire).
(Right) Gloster (Armstrong Whitworth) Meteor N.F.11 (two Rolls-Royce Derwent).



de Havilland Venom N.F.3 (D.H. Ghost).



Northrop F-89D Scorpion (two Allison J35-A-21).

Gloster Javelin FAW. 1. Powered, in its FAW. 1 form with two Armstrong Siddeley Sapphires, without reheat, the Javelin delta-wing, all-weather fighter is claimed by its makers to be capable of using all the increases in engine power that can be anticipated "in the foreseeable future." Up to the time of writing there has been no news that the FAW. 1 has achieved supersonic flight, but it is officially credited with a speed of 600-700 m.p.h. at 50,000ft—at which height it can fight.

The Javelin is unusual among delta-wing aircraft in having a tailplane. This, the makers say, is a major contributory factor to the exceptional take-off and landing characteristics of the aircraft and that—being movable in conjunction with the elevators—it ensures good manoeuvrability at all altitudes and speeds. Pilot and radar operator sit in tandem, behind the long radar nose, the form of which has been the subject of much experiment. Auxiliary fuel tanks can be carried beneath the engine nacelles. The production-type wing differs considerably in plan form from that of the earliest prototypes, having a distinct kink in the leading edge and increased chord at the tips. Span, 52ft; length, 57ft.

CANADA

Avro Canada CF-100 Mks 1 - 4. In its Mk 3 and 4 versions the Canadian-designed-and-built CF-100 all-weather fighter is firmly established in service with the R.C.A.F. The Mk 1 prototype had Rolls-Royce Avons, and the Mk 2 was a pre-production model with Avro Canada Orendas. Production of the Mk 3 began in September 1952 and was completed last July. Standard armament of this mark is eight 0.5in guns, fitted beneath the belly, but the Mk 4 is generally armed with batteries of Mighty Mouse folding-fin rockets. Some 48 of these missiles are carried in a belly pack, which extends, fires and retracts in a few seconds. Alternatively, in the same position, an 8 × 0.5in or 4 × 30 mm gun pack can be attached. Wing-tip pods contain more rockets, and, these having been fired, the pods would normally be jettisoned, thereby improving rate of roll by some 20 deg a second without prejudice to other aspects of performance. The fuselage nose, housing an automatic search and lock-on fire-control system, is supplied by Hughes Aircraft. Span, 52ft.

Avro Canada CF-105. Unofficial reports ascribe to this 52,000 lb, delta-wing, two-seater—intended as a CF-100 replacement—a speed of 1,200 m.p.h. and a range of 1,500 miles. Two turbojets of unknown type are specified.

U.S.A.

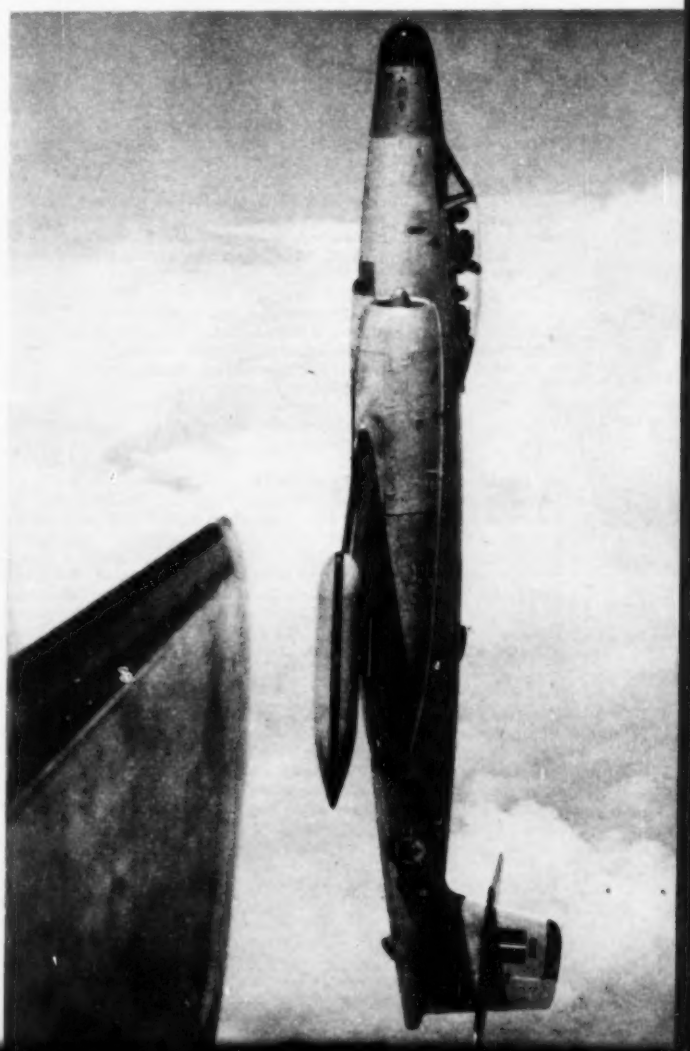
Lockheed F-94C Starfire. This is the last production version of the Lockheed Shooting Star/Starfire fighter series, and differs from its forerunners in having a thinner wing, redesigned nose, swept horizontal tail surfaces, revised vertical surfaces, and an all-rocket armament. It is powered with a Pratt and Whitney J48-P-5, with afterburner, and weighs well over 20,000 lb.

In a ring of firing tubes round the cylindrical nose are 24 Mighty Mouse rockets, and outboard, on the wing leading edges, are two pods, about 6ft long, and each containing 12 rockets. Radar and fire-control gear weighs about 1,400 lb. Span, 37ft 4in.

Northrop F-89D Scorpion. The Scorpion is the U.S.A.F. counterpart of Canada's CF-100 and the most recent operational version—the F-89D—is likewise rocket-armed. The "D" differs from the earlier variants in having a total of 104 Mighty Mouse rockets instead of six nose-mounted 20mm guns. The rockets are concentrated in two wing-tip pods, permanently fixed in position and, in conformity with modern practice, are electronically aimed and automatically triggered. A maker's announcement states that they "fan out in overlapping patterns like huge shot-gun blasts to blanket an area of sky as large as a football field." Flying weight of the Scorpion is about 20 tons and speed in the 600-m.p.h. class. It is capable of destroying enemy aircraft at heights above 45,000ft. Power plant is two Allison J35-A-21s with afterburners. Span, 56ft 2in; length, 53ft 4in.

Lockheed F-94C Starfire (Pratt and Whitney J48-P-5).

Avro Canada CF-100 Mk 4 (two Avro Canada Orenda).



de Havilland D.H.110 (two Rolls-Royce Avon).

Military Aircraft 1954

Fighters • MULTI-SEAT CARRIER-BASED

GREAT BRITAIN

de Havilland D.H. 110. The D.H. 110 first flew—as a land-based, all-weather fighter—in September 1951, and in April of the following year achieved supersonic speed in a dive. Thereafter a Mach number of 1 was frequently exceeded and the aircraft displayed such qualities of all-round performance and handling as to attract the patronage of the British Admiralty. Accordingly a prototype aircraft is now being adapted for deck operation, with arrester gear, folding wings and a new leading edge, having increased camber, as on the Comet. No production order has been announced, but clearly the 110 is foreseen as a Sea Venom replacement.

The two Rolls-Royce Avons are fed from root intakes, in characteristic de Havilland fashion, and it is evident that afterburners could be installed if demanded. The pilot's cockpit is offset well to port, and the radar operator is housed to starboard in a cabin, for which there are windows on the starboard side. The tailplane is unswept but of very thin section, the main wing flaps have rearward travel and are in four sections; and the dive brakes, conforming to the shape of the engine nacelles, are mounted on the central body.

Span, 51ft; length, 52ft.

de Havilland Sea Venom FAW21. The Sea Venom is the Naval counterpart of the N.F.3, as supplied to the Royal Air Force, and differs superficially from the earlier FAW20 in having a redesigned tail. Both are identified by an arrester hook, stowed in a prominent fairing on the rear end of the central nacelle. Armament is four 20 mm guns, and it has been announced at a Royal Naval flying display that a range of 1,000 miles is attainable. Fighters of this type are being manufactured under licence in France by the S.N.C.A.S.E. concern, under the name Aquilon.

Span, 41ft 9in; length, 35ft 3in.

U.S.A.

Douglas F3D-2 Skyknight. This side-by-side, two-seater, all-weather dates from 1948. Powered with two Westinghouse J34-WE-38 turbojets in underslung housings, its built-in armament is four 20 mm guns, though, as the photograph shows, four Sparrow air-to-air guided missiles can be carried as external stores. The main under-wing fittings are suitable for jettisonable tanks, 2,000 lb bombs, or Tiny Tim rockets.

The cockpit itself is arranged along U.S. Navy "standard cockpit" lines, and all letters and numbers are etched in Lucite and lit from behind by red light. Controls for flaps, undercarriage, arrester hook, etc., are designed in the shape of the component they represent, with a view to reducing pilot error. No ejector seats are provided, emergency exit being by way of an escape chute running from the rear wall of the cabin through the under-side of the fuselage; the hydraulically operated hatch acts as a wind-break. Development of a swept-wing derivative has been abandoned.

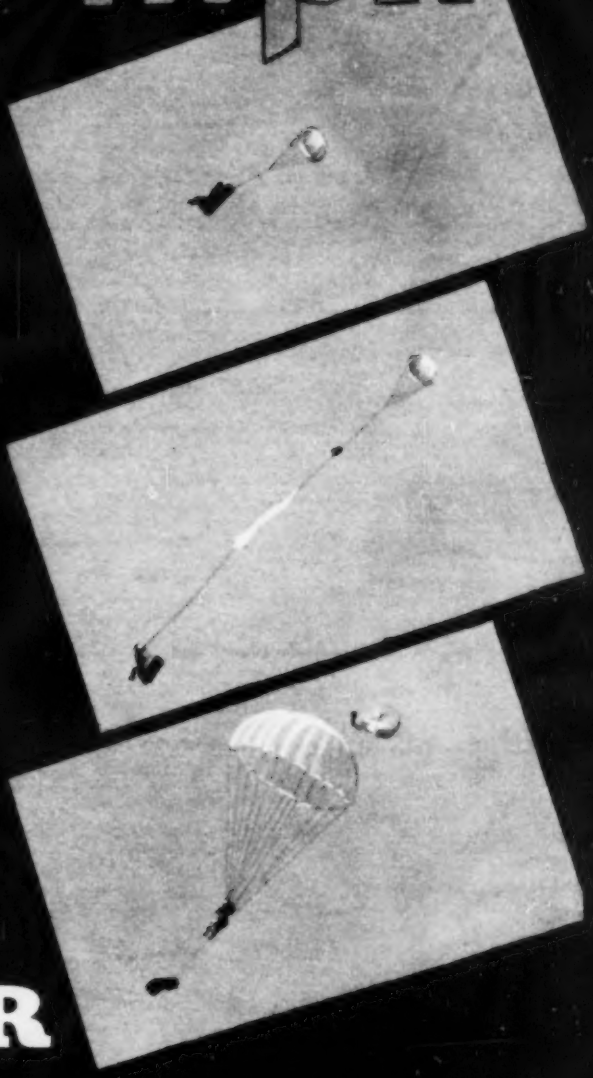
An American writer remarks, á propos the Skyknight, that although the U.S.A.F. is attempting to perfect the single-seat all-weather fighter, both its own engineers and those of the U.S. Navy recognize that maximum radar effectiveness can be guaranteed only by the use of a special radar operator, skilled in the use of the equipment and interpretation of its display. This, he avers, needs a two-man crew. Gross weight is little short of 30,000 lb. Span, 50ft; length 45ft 5in.

de Havilland Sea Venom FAW21 (D.H. Ghost).

Douglas F3D-2 Skyknight (two Westinghouse J34-WE-38).

at low altitudes each second is vital

150 ft. 600 mph



On the 17th March, 1954, an ejection in straight level flight was made from a Meteor 7 aircraft with the Martin-Baker Patent fully Automatic Ejection Seat.

- The speed 600 m.p.h., the height only 150 feet.
- One second after ejection, drogue developed holding seat steady and slowing it down.
- Three seconds after ejection, parachute fully developed with 80 feet in hand.

Patented in the principal countries of the world and certain patents pending.

MARTIN-BAKER

AIRCRAFT COMPANY LIMITED HIGHER DENHAM NEAR UXBRIDGE MIDDLESEX

Gun mounting, sand cast in Magnuminium for Sir W. G. Armstrong Whitworth Aircraft Ltd.

Whenever British Aircraft take the air . . .

HIGH DUTY ALLOYS

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Military Aircraft 1954

GROUND ATTACK

The favoured aircraft for low-level attacks on ground targets continues to be the adapted single-seat jet fighter, though Sweden (where a very great deal of ground-attack experience has been accumulated over many years) is soon to introduce an all-weather two-seater in this rôle. Contrary to the usual sequence of development, this machine—the Lansen—is also foreseen as a fighter. Such a relatively heavy and elaborate type appears to be widely at variance with the NATO specification for an attack aircraft to support ground forces. This is reported to call for a machine weighing less than 5,000 lb and capable of Mach 0.95 for 30 per cent of its mission and of 350 kt for the remainder. Rate of roll must be at least 100 deg/sec at Mach 0.9 at sea level and take-off, to clear a 50ft obstacle within 3,000ft, must be possible from a grass field. A typical operation would entail 150 miles at 350 kt, eight to ten minutes' search at the same speed, and the attack. The aircraft would then clear the target zone by 90 miles at Mach 0.95, after which it would return to base at low speed.

The specification calls for an armament of either two 20 mm guns with 200 rounds, or two 30 mm guns with 120 rounds. Possible external loads include twelve 3in rockets, two 500 lb bombs and two napalm tanks. For air-to-ground attack, a radar gunsight would be unnecessary; a gyro-sight with provision for rocket-aiming would suffice. Light armour is required. Not unexpectedly, the aircraft demanded must be robustly constructed, simple to maintain, and to have easy turn-round for high-intensity operations out of forward airfields. Pressurization is called for, as well as provision for a g-suit: air brakes should be fitted. Electronic equipment should include radar homing gear. U.H.F., D.M.E. and I.F.F. The aircraft would operate mainly at low levels, but it should, in an emergency, be capable of adaptation as a high-level intercepter—it is for this eventuality that the radar homing is specified.

Specialized anti-tank "missile platforms," such as the Potez 75, may find an application in future warfare, as indeed may the very simple light and economical machines typified by the Fletcher FD-25B Defender. The design philosophy behind this last-named aircraft is summarized by its makers thus: "The FD-25B is not intended to operate in the 'wild blue yonder'; that area belongs to the jet and its highly trained pilot. Nor is the jet designed for close-in ground support—'blasting out' those ever present tight little enemy pockets which are so costly to our ground forces in time and lives. Such jobs require the services of a small, light-weight, but highly manœuvrable airplane capable of delivering pin-point destruction on the enemy."

GREAT BRITAIN

Avro Fighter/Bomber. Designed to meet the NATO requirements outlined in the introduction to this section, this projected machine is a delta, developed from the 707 research family. The makers claim that it will be able to land without trouble on a minimum p.s.p. runway with room to spare, and take off in half the minimum requirement. It will carry a heavy mixed load of rockets, guns and bombs, and is designed to exceed NATO requirements in terms of speed and range. It will have no tail. Price is quoted as "a third of that of the conventional fighter."

de Havilland Vampire F.B.5 and F.B.9. Although Vampires still remain in fighter squadrons of the R.Aux.A.F., it is as a ground-attack aircraft that this type is now primarily considered. The F.B.5 and 9 are similar, except that the 9 has a refrigeration unit and other detail modifications. Numerous export versions are generally similar. Vampire ground-attack loads are eight 60 lb R.P.s and two 500 lb bombs, but the bombs can be carried only if the auxiliary fuel tanks are dispensed with, whereas in the later Venom an external armament load heavier than that of the Vampire can be carried with tip tanks in place.

de Havilland Venom F.B.1 and F.B.4. Seen below carrying two 1,000 lb bombs, the Venom F.B.1 is also adaptable—as is the F.B.4—for a variety of bombs of other calibres, for clusters of small bombs, rocket projectiles, and no doubt for napalm tanks. Built-in armament is four 20 mm guns.

Gloster Meteor F.8. Although the special ground-attack development of the Meteor, described at some length in the former review of this series, has not passed into production, the standard Meteor F.8 fighter was used with notable success in Korea, with an armament of eight or sixteen 60 lb rocket projectiles.

FRANCE

Potez 75. The most detailed appreciation of this unique aircraft yet published appeared in *Flight* of May 14th and began: "Few Englishmen would be able to appreciate the full implications of the problem which first suggested to M. Henri Potez the development of a specialized 'defence vehicle'; yet this particular problem has always existed for the Continental nations, whose land frontiers are so much more easily invaded than England's moated shores. Whereas our first line of defence lies in the skies over and beyond the Channel and North Sea, French soil must always be considered vulnerable to direct ground attack by fast-moving armoured columns. This was poignantly demonstrated during the initial German break-through in the Ardennes in 1940: the Germans thrust rapidly straight to the Channel coast, and the defenders on the ground found themselves unable to bring effective weight to bear on the enemy's relatively dispersed armoured spearheads. The situation was confusingly fluid, and the roads were hopelessly cluttered with fleeing refugees.

"It was this state of affairs that led the eminent French aircraft designer to study the possibilities of an effective weapon which, operating away from roads yet using natural cover, could be employed to attack the armoured spearheads while they were still on relatively unconsolidated territory. The eventual result of the study was the Potez 75. It is a machine which must be considered as an army missile-launcher that flies."

The Potez 75 weighs 5,280 lb all-up and has a Potez 8-D32 engine giving 480 h.p. for take-off. It is intended to operate at very low levels from unprepared ground—even from tilled land or stretches of road. Using trees and buildings as cover, it would stalk a target "on the deck," thus avoiding possible radar detection and delaying visual sighting until it was too late to bring concentrated flak to bear.

The guided missiles intended for the aircraft are still more or

de Havilland Venom F.B.1 (D.H. Ghost), with two 1,000 lb bombs.

Military Aircraft 1954

Ground Attack

Potez 75 (Potez 8-D32).

less secret, though they are said to be very simple, extremely accurate and, of course, armour-piercing.

Span, 42ft 11in; length, 30ft; max. speed, 171 m.p.h.; take-off run, 190 yd; landing run, 180 yd.

S.E.5000 Baroudeur. A wholly new approach to the problem of the high-performance ground-attack aircraft for operation from advanced bases, the Baroudeur takes off from a jettisonable trolley and lands on skids. The trolley—a remarkable piece of work, which took a year to develop—has a steel-tube framework and three wheels with large-diameter medium-pressure tyres. The twin front wheels are free to caster for ground handling and the main rear wheels have differential brakes, operated from the rudder pedals. For take-off two or four rockets are attached to the trolley, which runs true, with or without load, on rough ground. The makers claim that the Baroudeur can be mounted on its trolley in just over a minute by means of a jeep which uses its power to winch the machine up over spiral rollers; these automatically centre the fore and aft "keel." At the rear are side pads for steadying, and a front support holds the nose while this is locked on to the trolley by means of a bomb slip.

For take-off the pilot opens up the Atar turbojet and fires the rockets. When unstick speed is attained a warning lamp lights and the pilot releases the bomb slip; thereupon he eases back on the control column, the front support following the nose as it rises, and the aircraft flies off. The brakes on the main wheels are automatically applied and arresting tines are lowered into the ground to stop the trolley in less than 100 yd. An ingenious feature of the tines is that they are double-ended and are mounted at their mid-point on a spring-loaded pivot so that, should one encounter a stone, it will turn over and present its other end instead of breaking. It is claimed to be possible to take off with full load in less than 1,000 yd.

No weights have been disclosed, but the equipped weight is between 1,500 kg and 2,000 kg less than that of the Sabre. Span is 32ft 10in, length 44ft 3in.

S.E. Grognard. Although this twin-Nene attack aircraft is not being developed, it is one of the few machines of its class for which intended armament loads may be quoted. Representative of these (additional to two Hispano-Suiza Type 603 30 mm guns, each with 200 rounds) are: 16 rockets of over 140 lb each in the fuselage bay; 200 9 lb anti-personnel rockets; three 750 lb bombs; or four 770 lb napalm bombs.

SWEDEN

Saab-32 (A-32) Lansen. This two-seater was built to meet the requirements of the Royal Swedish Air Board for an aircraft primarily intended for attacks on ground and sea targets. The prototype flew in November 1952, powered with an early mark of Rolls-Royce Avon, and production machines will have Swedish-built Avon RA.7Rs, with afterburning. A prototype has exceeded Mach 1, under complete control, during early dive tests.

The wing has 35 deg of sweepback at 25 per cent chord, hydraulically boosted ailerons, and Fowler flaps; the automatic leading-edge slats of the first prototype have now been replaced by boundary-layer fences. The fuselage incorporates four air brake sections at the rear, and the Avon RA.7R (which bears the Swedish designation RM5) takes in air through flush intakes. Ejector seats of Saab design are provided in the pressurized cockpit. External provision for bombs, rockets or guided missiles, and an unspecified gun armament is built into the fuselage. All-up weight is about 22,000 lb, span 42ft 8in, and length 49ft 2in.

Saab A-29. This is the specialized ground-attack version of the J-29 single-seat fighter already referred to, and has under-wing provision for offensive stores.

U. S. A.

Chance Vought A2U-1. Derived from the F7U-3 (itself capable of being catapulted with about 5,500 lb of bombs), the A2U-1 can be catapulted with more than 9,000 lb. It has longer range and increased armour protection.

Fletcher FD-25B Defender. The cheap-to-buy, cheap-to-operate Defender weighs a mere 2,700 lb and is powered with a Continental E225 engine of only 250 h.p. A maximum sea level speed of 187 m.p.h. and a landing speed of 45 m.p.h. are claimed, and the sea-level rate of climb is quoted as 1,725 ft/min. Take-off distance is 330ft. Possible armament combinations (in addition to two 0.3in guns with 1,000 rounds of ammunition each) are forty 2.75in rockets, four 5in rockets, two 40 U.S. gallon napalm tanks, or two 250 lb general-purpose bombs.

North American F-86F. Now extensively employed by fighter/bomber wings of the U.S.A.F., the F-86F has under-wing tank pylons mounted farther outboard than those of preceding Fs,

S.N.C.A.S.E. 5000 Baroudeur (S.N.E.C.M.A. Atar). The aircraft is shown leaving its launching trolley.

Saab-32 (A-32) Lansen (Rolls-Royce Avon).

to make way for bomb shackles and rocket rails. Other developments include the fitting of armour plate in the area surrounding the all-flying tail actuator, and a re-running of the hydraulic system (originally, both main and emergency hydraulic lines ran together at several points, but in the F they are widely separated in order to reduce the chance of complete failure from battle damage). Present offensive load is two 500 lb or 1,000 lb bombs.

When the F-86F and other marks of Sabre were reviewed in detail in *Flight* of January 15th this year, it was remarked that a new bomb-aiming device, developed by North American, had been retrospectively fitted throughout all fighter/bomber wings equipped with the F. The equipment consists of two "black boxes," permitting manual control of the "pips" on the sight with which the pilot can make faster adjustments to the sight before peeling off for a dive attack. It also cages the sight. Originally, the pips could disappear from view following any unexpected swerve during the dive, such as might have been required to avoid an accompanying aircraft.

The sight fitted to the F is the new A-4, which is giving accurate results and is more reliable and easier to maintain than the A-1 radar sight used in combat on earlier Sabres. A major re-design of the system now houses all the components in easily removed packages. For dive-bombing, the sight is switched to "rocket," the attack being made at 70 deg. It is advantageous both from the point of view of accuracy and penetration that the terminal velocity of the F with tanks on is very near to the critical velocity of the bombs used. Built-in armament remains six 0.5in guns.

North American F-86H. An important fighter/bomber variant of the Sabre, referred to on page 825.

Republic F-84G Thunderjet. Indicative of the ground-attack capacity of the Thunderjet is a statement by the makers that, in the course of a 100-mission combat tour, a typical fighter/bomber pilot operating this type of aircraft in Korea fired more than 180,000 rounds of 0.5in ammunition, dropped 220 tons of

North American F-86 with ground-attack loads

Below) Republic F-84F Thunderstreak (Wright J65).

Fletcher FD-25B Defender (Continental E225).

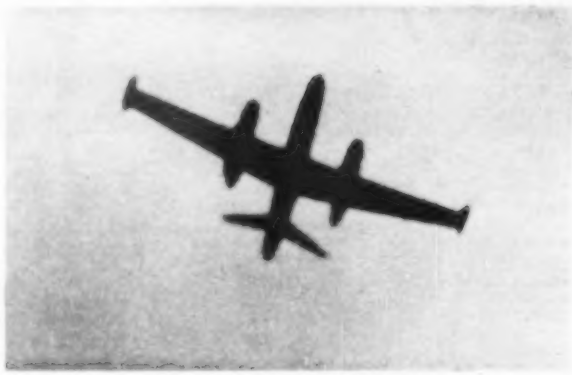
bombs, fired 350 rocket projectiles, and dropped 2,500 gallons of napalm. It is known that the F-84G is equipped to carry the "tactical" atomic bomb, but more representative loads are thirty-two 5in rockets; sixteen 5in rockets and two 11.5in rockets; or eighteen 5in rockets and two 1,000 lb bombs.

Republic F-84F Thunderstreak. Provision is made beneath the wings of the Thunderstreak for—among other loads—thirty-two 5in rockets, eighteen 5in rockets and two 230-gallon fuel tanks, or two 1,000 lb bombs and eighteen 5in rockets.

Military Aircraft 1954

BOMBERS

Drawing of Douglas RB-66 (two Allison J71).



Il-28 (two Nene-type turbojets).

Though the capabilities of the high-level jet bomber were first demonstrated in service by the North American B-45 Tornado, it was the Boeing B-47 and the English Electric Canberra which first established transcendent standards of altitude and speed.

Obviously restricted in height and manœuvre by a higher wing loading than previously contemplated for a bomber, Boeing's B-47, of which many hundreds are already in service, is somewhat faster than either the B-45 or Canberra and has a longer range, while in all aspects of performance our own Vickers Valiant, Avro Vulcan and Handley Page Victor, America's Boeing B-52, and new Russian bombers should prove tough propositions for the best contemporary fighters. Advanced aerodynamic thought, manifest in curious wing forms, should combine with high available thrust in such aircraft to achieve cruising speeds of some 550 m.p.h. at levels around 50,000ft, while moderate—even low—over-target loadings should confer a high standard of manœuvrability.

Though it was considered in the early days of jet-bomber development that bomb loads would be relatively light, due to the heavy demands on weight and space imposed by the fuel load, the now-elderly B-45 proved capable of carrying 20,000 lb of bombs. The later, larger B-47 takes a similar load and the B-52 should easily handle 75,000 lb.

The difficulties of releasing bombs with accuracy persist, and must become more pronounced as speeds increase still further. As for the bombs themselves, it is certain that some of the larger types must have guidance systems, and in this matter we can do no better than to recall a leading article in *Flight* of December 1952, referring to a statement by the then C-in-C. Bomber Command that "we have got to get away from this free-falling-bomb business and put as much effort as we can into the guided bomb as quickly as possible." We then observed that a 1,000 lb bomb having a terminal velocity of some 500 kt took about a minute to reach the ground when released from 50,000ft at a speed of 600 kt, which meant that the modern bomb-aimer might have to release between eleven and twelve miles short of his target.

What, we asked on the same occasion, were the possibilities of guided bombs being made available for use with the V-bombers? "Adverting to Sir Hugh Lloyd's recent utterance," we observed, "we notice this brief but significant qualifying sentence: 'I am sure it can be done.' From this we may deduce (1) that guided bombs are nbt yet available to Bomber Command; (2) that there remains some question as to their feasibility. Against these deductions may be set the known facts that guided bombs were employed in the late war by Germany and America, and that post-war development in the U.S.A. has not lapsed. Detailed knowledge of British research is, quite rightly, denied us; but we are surely entitled to suppose that the guidance of bombs is no new field of investigation for our armament technicians, for to them, as to the men who design and man our new bombers, we look for the fashioning of the 'rapier' which, we are told, must supersede the erstwhile 'bludgeon' of Bomber Command."

The doctrine of performance-above-all has led to the abolition of defensive armament on British bombers, though the U.S.A. and Russia have shown greater reluctance to denude their aircraft of protective ordnance—have, indeed, developed efficient radar-laying systems for respectable concentrations of guns, 2 × 20 mm being typical. Little has been heard of bomber-defence missiles, and the problems of launching these at speeds upwards of Mach .9 may well be imagined.

While the "built-in" range of even the newest bombers could hardly suffice for the deep-penetration knock-out raids which might mark the start (and the finish) of another war, their lethal reach could be greatly extended by flight refuelling. Already highly developed, this has been proved a practical proposition even under adverse conditions.

For the future, America at least is looking to bombers with supersonic capabilities, the first (if not the only) example of which will be the Convair XB-58 Hustler. Long-range pilotless bombers are not immediately at hand, but the tactical Martin Matador is already in service and will have due consideration in these pages.

Present-day tactical bombers of the piloted kind are best exemplified by the Canberra, its American variant the B-57, and by Soviet designs of dubious derivation; and closely related, but mounting air-to-air armament in addition to, or instead of, bombs, are the intruders, whose task is to disrupt the enemy's air and ground effort in his own territory, especially by night. The ultra-low-level bomber, capable of penetrating beneath enemy radar, remains an interesting possibility.

S.N.C.A.S.O. 4050 Vautour (two S.N.E.C.M.A. Atar).

Bombers • TACTICAL & INTRUDERS

GREAT BRITAIN

English Electric Canberra B.2, 5, 6 and 20. These four operational developments of the original Canberra B.1 "radar" bomber incorporate a revised nose for visual bomb-aiming. They are three-seaters (pilot, navigator/plotter, observer), and to a large extent the navigator/plotter and observer are interchangeable, though it is usually the former who navigates the machine to the target and the observer who, before the run-in, takes up position to aim the bombs. The B.2 is in service with the R.A.F. and Venezuelan Air Force, and the B.5 "target marker" differs from it in having a largely opaque nose with a large-area, optically flat panel beneath. The B.6 is a developed B.2, with a lengthened nose and Avon turbojets of later series; and the B.20 is the Australian-built variant now in production at the Government Aircraft Factory at Melbourne.

Performance and weight particulars are still withheld by the Air Ministry, but in the absence of these the following extracts, from an account by the Editor of flying on a Canberra sortie, are reprinted from *Flight* of August 28th, 1953:

"The practice is to go rapidly up, first at a steady airspeed then at a predetermined Mach number. As the air gets thinner the noise seems to get less.

"On the rumble-seat beside the pilot I had just sufficient room to perch on a dinghy pack and look out without interfering with the pilot's elbow-movements. I was glad to have sunglasses, because the sun is particularly brilliant and the very fact of having nothing but bright distance to gaze at seems to put some strain on one's vision. Perhaps either the scarcity of focal points or the great distance apart of those which there are has the effect of over-exercising one's powers of accommodation . . .

"One often hears that it is extremely difficult to see other aircraft at very high altitudes, and this I can certainly confirm; not only had I great difficulty in seeing another Canberra which I knew to be quite close to us, but having lost sight of it for a period of minutes, I suddenly found it reappearing as large as life and only a few hundred yards away at the front end of a momentary contrail . . .

"Having levelled out at about 42,000ft we settled down to a brief period of cruising at around 500 m.p.h. before starting on a long let-down. Within a few minutes of seeing the last of the English coastline through the cumulus clouds, we were able to see Holland and the Island of Texel ahead . . .

"Complete calm reigns at eight miles high, and thus the very occasional tremor of high-altitude turbulence is a matter for comment—always supposing that the sensation is not the onset of compressibility effects. This can be checked by the Machmeter.

"At top altitude the Canberra remains unexpectedly manœuvrable and responsive to controls. At night and into sun the pilot must fly frequently by instruments: this calls for great care and accuracy, for much the same reasons as it did on the Mossie, when loaded and high, in war-time. A small change in fore-and-aft attitude causes a quite disproportionate alteration in speed and height. By a different token, the high speed results in a big error in position if the course wanders for only a few seconds.

"An indication of the speed of covering ground—or air—is given by our timetable. The route Bremen (take off for return), North Sea (well up towards Norway), Edinburgh, Glasgow, Barrow, Northern Ireland coast, Isle of Man, Manchester, Grimsby, seventeen miles N.E. out to sea and back to Binbrook took under 2½ hours . . .

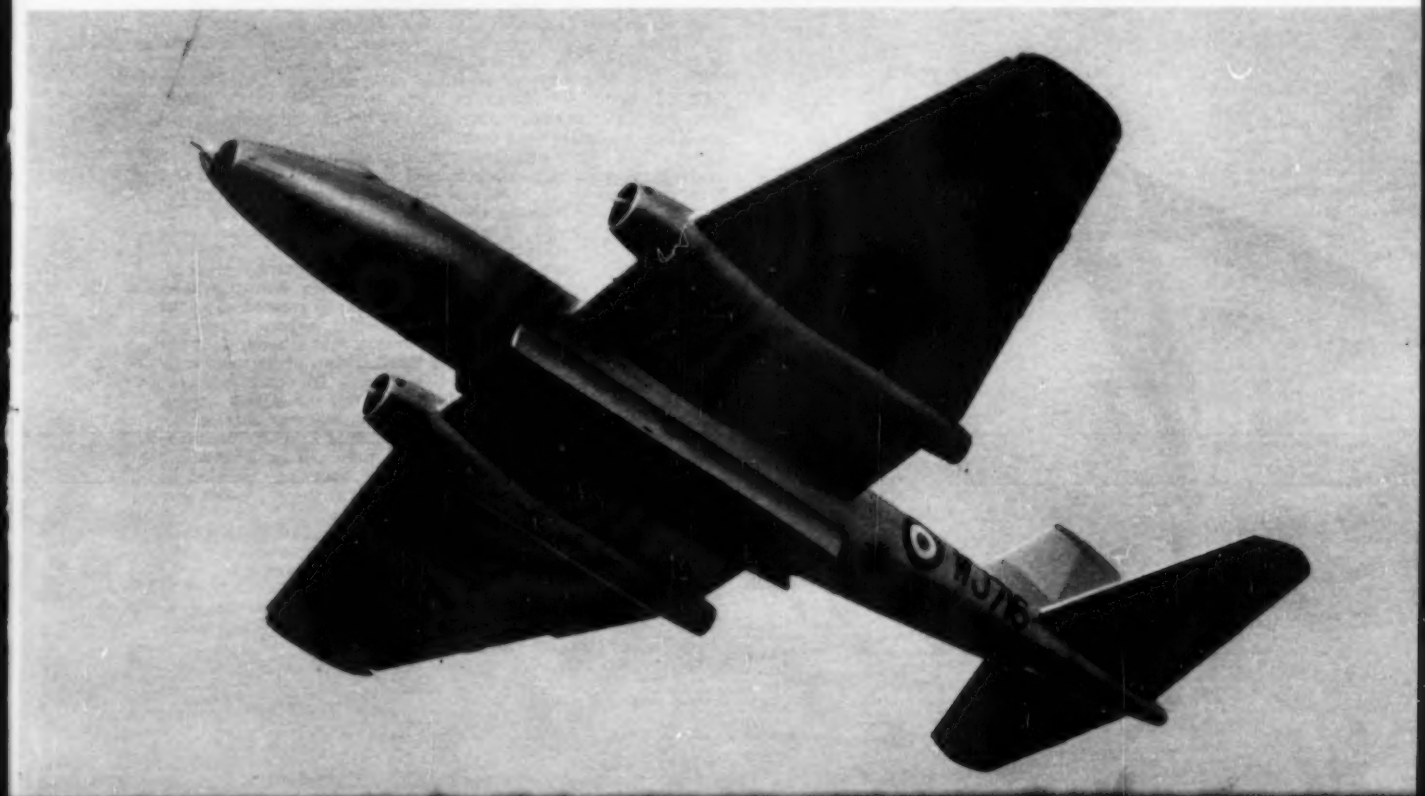
"On occasions during descent, the air-brakes were used, and without clawing the aircraft back they were most effective in preventing excess speed building up. At all times during the flight when changes of speed or attitude were made, the pilot used the variable-incidence tailplane with a flick backwards or forwards on the controlling switch.

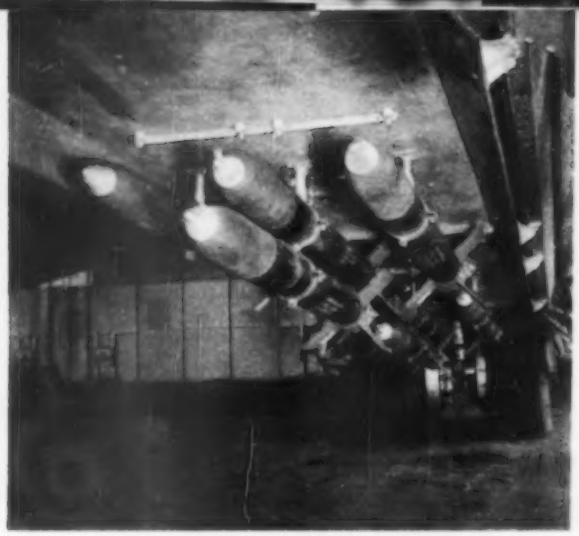
"As would be expected with the big increase in keel surface which the open bomb doors give, the aircraft becomes more stable directionally, and this calls for more use of controls to effect a change of heading on a bombing run. The plotted results for Canberra squadron bombing practices from 20 to over 40,000ft indicate that while never so good that an improvement cannot be made, they already indicate a satisfactory standard both for visual and blind dropping."

Span of all Canberra bombers is 63ft 11in. Length of the B.2 is 65ft 6in and of the B.6, 66ft 9in.

Martin B-57 (two Wright J65).

English Electric Canberra B.2 (two Rolls-Royce Avon).





Rotary bomb bay of Martin XB-51, showing rocket projectiles.

Military Aircraft 1954

Bombers • TACTICAL & INTRUDERS

FRANCE

S.N.C.A.S.O. 4050 Vautour. Although a single-seat ground-support version and two-seat all-weather fighter and reconnaissance versions of this twin-jet, multi-purpose aircraft are being developed the type is considered here as a light bomber.

The design dates back to July 1951, and the first flight was in October 1952. Structurally the aircraft is notable for the extensive use of metal-to-metal bonding. Following the American example the main undercarriage is of tandem-wheel type, retracting into the fuselage, with outrigger wheels rising into the nacelles. The irreversible powered controls have artificial feel.

The first prototype is fitted with S.N.E.C.M.A. Atar 101B turbojets, and the second with Atar 101Cs. The makers claim that the external mounting of the engines permits the installation of various types, with ratings up to 10,000 lb static thrust, and it is planned to install the Atar 101D and E, developing, respectively 6,600 lb and 7,250 lb thrust. One aircraft is being adapted for Armstrong Siddeley Sapphires and the fitting of Rolls-Royce units of unspecified type is under study. The claim is made that the Vautour's speed in level flight "ranges over and above 680 m.p.h., according to the type of engines fitted," and that at high altitude Mach 1 is exceeded in a very slight dive. Take-off with a "normal load" is possible from runways measuring less than 2,650ft, and a tail parachute shortens the landing run. Low-pressure tyres (made possible by the fuselage-housed main undercarriage) permit take-off and landing from temporary strips. Maximum "ferry" range is about 3,700 miles and 40,000ft is said to be attainable in 6 minutes.

In the bomber version the nose is glazed and houses the bomb-aimer and his equipment. It is recognized that the Vautour is "the lightest of all bombers"; yet the claim is advanced that it will carry an atomic weapon over a range of 1,240 miles—more than sufficient, it is pointed out, for operations in the European zone. "It has a speed greater than that of other existing bombers," say the makers, "and it is practically invulnerable to the most recent fighters." Span is 51ft, length, 49ft 6in.

Martin B-61 Matador (Allison J33).

RUSSIA

Soviet Light Bombers. Available evidence suggests that the most commonly used light bomber of the Soviet Air Force is the Il-28, powered by two Nene-type turbojets in underslung nacelles, into which the main wheels of the undercarriage retract. This is a straight-wing aircraft with swept-back tail, and is shown in a photograph on page 834. A bomber of similar character is the so-called "Type 35," which may have been developed for the Soviet Navy. A swept-wing development of the Il-28 is reported, and a new-type, swept-wing, twin-jet bomber participated in the last May Day fly-past over Moscow.

U.S.A.

Douglas B-66B. This swept-wing, twin-jet bomber for the U.S.A.F. is a development of the U.S. Navy's A3D Skywarrior, to which reference is made under *Carrier-borne Strike*. Allison J71-A-9 turbojets are specified, and there will be tail armament. A report that a K5 radar-bombing system (developed by Bell Telephone Laboratories and produced by Western Electric) has been delivered to Douglas may relate to this aircraft.

Martin B-57A and B. These "Americanized" versions of the English Electric Canberra are, respectively, a light bomber and a night intruder, the former resembling in appearance the British-built Canberra bombers, though it is powered with Wright or Buick-built J65s (Armstrong Siddeley Sapphire licence). According to American reports, the "B"—similarly powered—will have an armament of 20 mm guns and an assortment of other weapons to suit it for its particular role. More noticeably, the crew of two will be seated in tandem beneath a long canopy, which was mocked-up and test-flown on an early British-built Canberra last year. Another innovation on the intruder will be fuselage air brakes in addition to the existing finger-type brakes.

A significant development on the American-built Canberras is the incorporation of the Martin rotary bomb bay, said to permit bombing runs to be made at speeds as high as those attained by fighter/bombers with their externally carried weapons. The new bay was originally developed on the three-jet XB-51, when it was found that high-speed bombers were subjected to heavy turbulence when the bomb-bay doors were opened. Furthermore, a bomb itself was liable to be caught and held at the mouth of the bay by turbulence, and if it did not fall away might strike either the bomb immediately behind it or the tail of the aircraft. Large bombs might also "tumble," with consequence reduction in accuracy.

The Martin bomb bay is in the form of a rotating platform on which the bombs are carried. The under-side forms the under surface of the fuselage, and the whole can be rotated about its fore-and-aft axis, thus exposing the bombs without creating a large opening in the fuselage. To ensure that a bomb does not tumble or strike the aircraft, it is "kicked" out of its shackle by two air-actuated plungers and a radius arm. There are two types of platform—the "A," which carries all but the largest bombs, and the "B," which bulges the fuselage contour so that the largest bomb can be carried internally. For loading, the entire platform is lowered from the aircraft, mounted on wheels and taken to the bomb dump. It is hoisted back into position by three standard bomb hoists. As the picture shows, rocket projectiles can be carried in place of bombs.

Martin B-61 Matador. This weapon is impartially described as a pilotless tactical bomber and a surface-to-surface guided missile. It takes off from a special mobile launcher, seen in the picture, under the power of its Allison J33 turbojet, assisted by jettisonable rockets. Unofficially reported to cruise at about Mach 0.9, it is said to dive on to its target at supersonic speed. A number of Matador squadrons are in service.

Military Aircraft 1954

Bombers • MEDIUM & HEAVY

GREAT BRITAIN

Avro Vulcan B.1. The first prototype of this delta-wing bomber flew with four Rolls-Royce Avon turbojets in August 1952, and was subsequently fitted with Armstrong Siddeley Sapphires. A second—Bristol Olympus-powered—took the air last year, and performed at the S.B.A.C. Display. This differed from the first (illustrated on this page) in having a bulge under the forward fuselage.

The design philosophy of the Handley Page Victor will later be outlined and it is fitting that the reasoning behind the Vulcan is also placed on record.

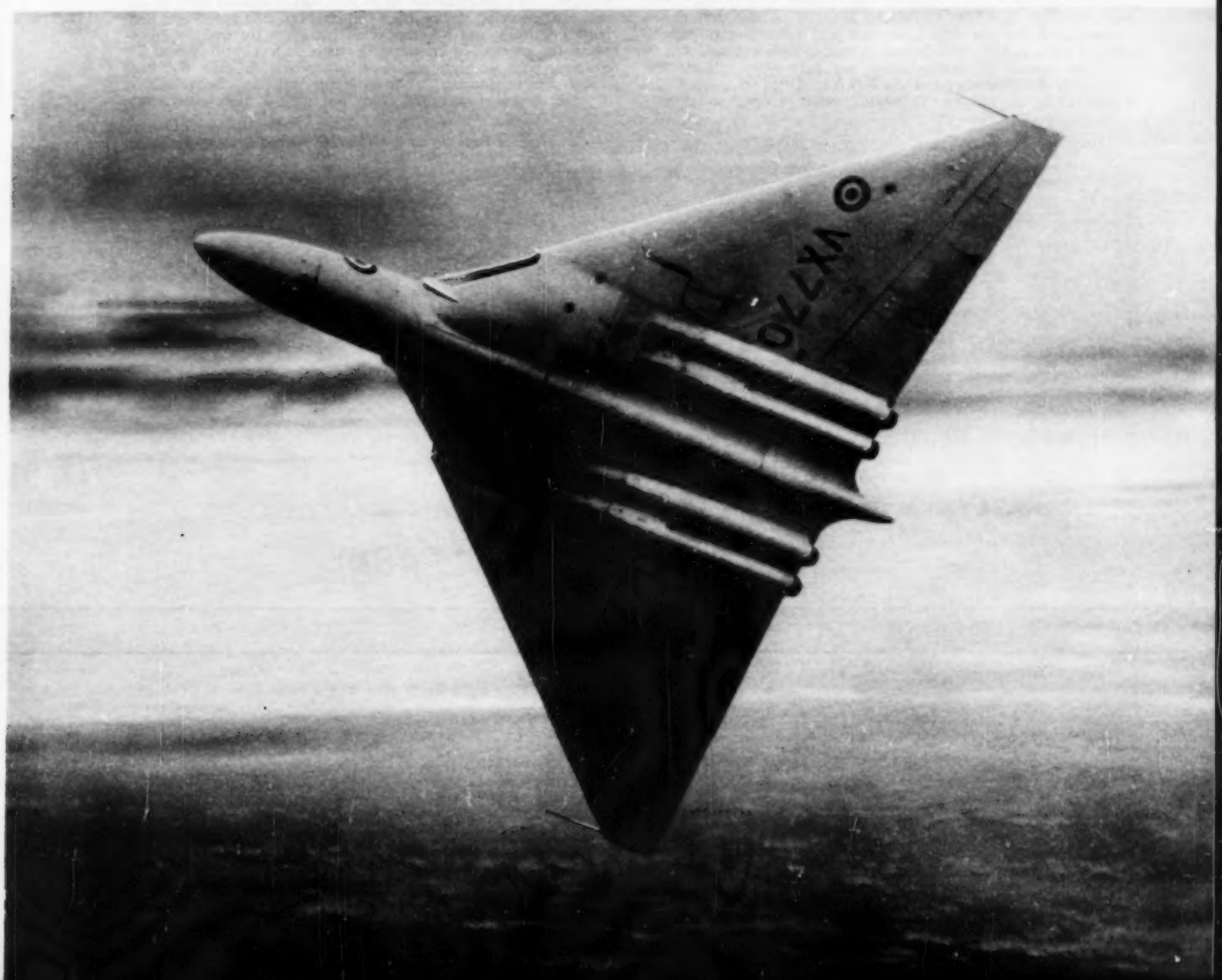
The Avro company began investigations into the optimum configuration for a high-performance, long-range bomber during 1947. It became obvious that, for an aircraft of this nature, the speed at which the compressibility drag-rise became marked must be chosen as the cruising speed, since any attempt to cruise faster would result in severe loss of range. The various ways of increasing the drag-rise Mach number were investigated, and it was found that the desired cruising Mach number settled the sweepback, wing thickness and wing loadings at such values that a conventional layout with the then-normal values of aspect ratio would result in an inordinately high structure weight. In fact, a vicious circle was soon reached in which the increasing structure weight, due to the high aspect-ratio swept wing, appeared to swallow the remaining payload and render the concept uneconomical. There seemed to the Avro team to be no way of lifting the design out of the critical state which had been reached. One obvious step seemed to be that, as so much sweepback was incorporated, the tailplane, with its drag and weight, might well be dispensed with, and the wing-tips used as a means of longitudinal control. Even so, the design seemed to be disproportionately large for what it had to do; moreover, the wing was still heavy and aeroelastic problems "frightening."

A family of designs with progressive reductions in aspect ratio was thereupon studied, and this soon appeared to be a move in the right direction. The outcome of these studies was the delta which, with its long root chord, enabled the tailplane to be eliminated. Furthermore, this plan-form held out possibilities of development in the direction of sonic speeds with the minimum change of trim and handling characteristics due to high Mach number. From the structural and operational point of view the delta held possibilities of utilising the large internal volumes of the wing for stowage of fuel, undercarriage and engines, thus cutting down the external drag to the minimum. The low wing-loading that would be required to meet the performance level at high altitude in itself gave good take-off and landing characteristics without the use of flaps or other high lift devices. Also the low aspect-ratio wing was fundamentally a stiff structure and less likely to suffer from aeroelastic distortion effects, such as flutter and control reversal, than a conventional highly-swept-back wing. Finally, the simplicity of the overall layout seemed to lead to advantages in design and manufacture.

After consideration by the Ministry of Supply technical staff, it was decided to proceed with the design of the 707 small-scale delta-wing research aircraft, and in the light of experience with a series of such machines the Vulcan was built.

Discussing supersonic performance in 1952, Avro's chief designer said that he preferred to keep an open mind as to the most desirable plan form. He thought it was possible that with sufficient technical ingenuity a highly swept-back aircraft with a

Avro Vulcan B.1 (the first prototype, with four Armstrong Siddeley Sapphires, is shown; production aircraft have Bristol Olympus).



Military Aircraft 1954 | **Bombers** • MEDIUM & HEAVY

tail could compete with a delta; but all other things being equal, a delta always scored by virtue of its simplicity. (In this connection it may be remarked that America's new supersonic bomber—the Convair XB-58 Hustler—will be a thin-wing delta).

Tip-stalling, he said, perhaps ought to be a problem with the delta, but the 707 appeared incapable of displaying any aerodynamic vice at all. The stall was quite straightforward and very gentle. Spinning, on the other hand, was not a practice to be recommended, and once any tailless delta was properly settled into a spin a pilot might not be able to recover. This, it is felt by the Avro company, should not be of great importance, since the stall occurs only at an extreme angle of attack, which would be impossible to attain unless deliberately sought. In respect of Dutch roll, the delta is said to be no better or worse than any other aircraft with similar sweepback, the problem being not purely one of plan form but depending upon distribution of moments of inertia and fin and rudder area. The American expedient of fitting some automatic yaw-stabilizer might be applied to deltas.

The Avro designer deprecates reference to the delta as a tailless aircraft and suggests that it may be imagined as a normal aircraft with a highly swept-back wing and a small tail fitted in line with the wing—in other words, all that the delta wing does is to fill up a gap between the main wing and the tailplane. To his company, it seems of little advantage to add an extra tail surface, with resultant weight and drag, though if such surfaces are fitted with a reasonable arm from the c.g., they do permit the fitting of landing flaps, and thus reduce the ground incidences on landing. As for the tailplane on the Gloster Javelin, the Avro chief designer says that he would not like to say that either Glosters or Avros are wrong, for each had different problems to contend with, and this was bound to lead to different solutions.

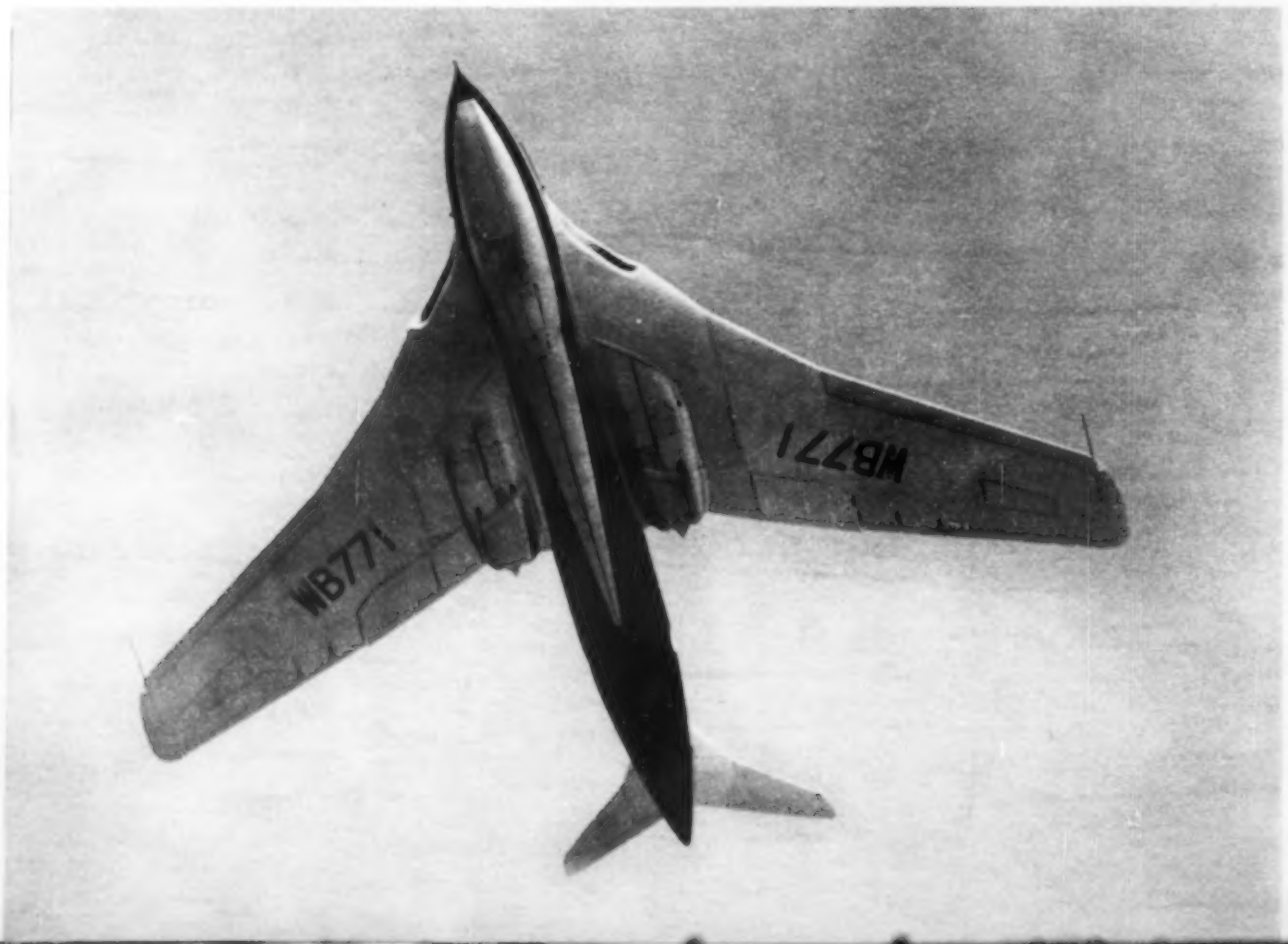
In the matter of performance, we may only adduce the spectacular demonstrations at the S.B.A.C. Displays and a flight at 50,000ft by the Minister of Supply which received some publicity last March. On that occasion the Minister remarked, "We are all much encouraged by the splendid performance of the Vulcan. In test flights in the last few weeks it has shown that it is capable of more than meeting the exacting requirements in both height and speed laid down in the R.A.F. specification of performance. For a large aircraft it is also proving itself exceedingly manœuvrable at high altitude and speed. These results well justify the adventurousness of its designers and the risk taken by the Government in ordering production before the first prototype had ever flown. The two prototypes which are now being tested have, of course, not yet been pushed, and there is little doubt that the Vulcan still has quite a lot up its sleeve." It may be added that the projected Avro Atlantic transport, which is based on the Vulcan, is designed to fly non-stop London to New York in 5-6 hr, cruising at over 600 m.p.h. at 40,000ft.

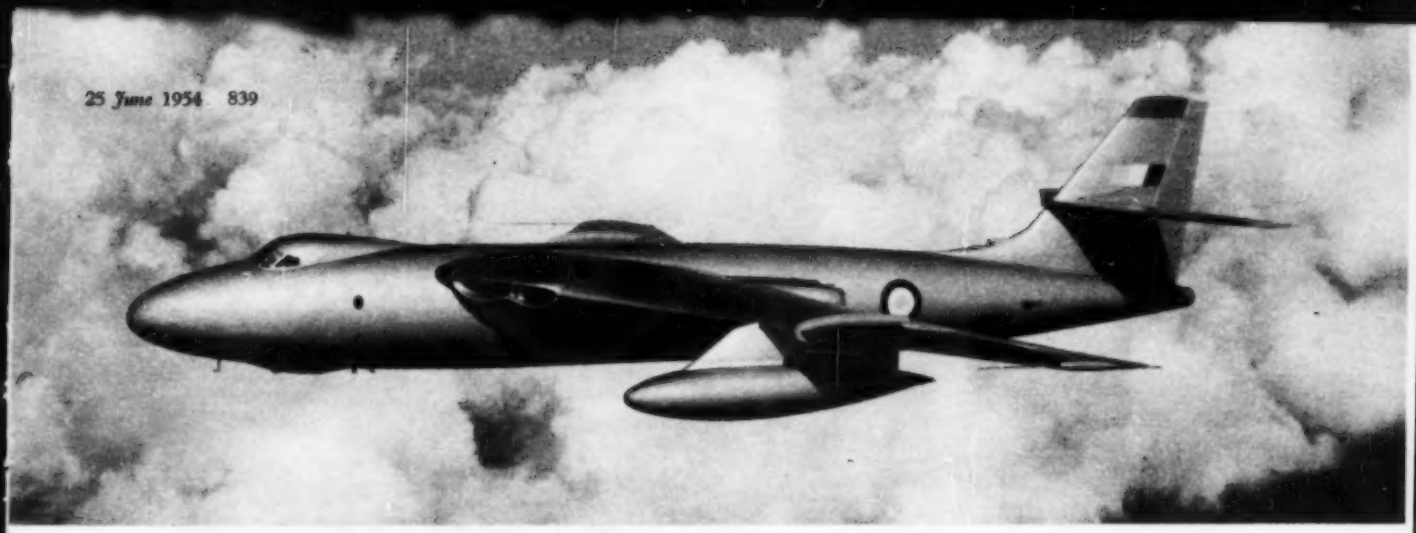
Handley Page Victor B.1. The first prototype of this, the third of Britain's V-bombers, flew on December 24th, 1952, and the flight trials of a second specimen are imminent. The appearance of the first machine is admirably seen in the photograph; the second (judging from a model shown at the S.B.A.C. Display last year) differs in having a lengthened nose of smoother contour, and a revised tail unit, without the dorsal fin and frontal intake which are characteristic of the first. Four Armstrong Siddeley Sapphires form the power plant of both prototypes and of forthcoming production machines.

In view of our previous allusion to the striking dissimilarity between the wing forms of modern jet bombers, it is noteworthy that the deputy chief designer of Handley Page, Ltd., has declared that it appears that the three different approaches—crescent (Victor), delta (Vulcan), and straight wings with moderate sweep, high aspect-ratio and podded power units (Boeing B-47 and B-52)—obtain the necessary high critical Mach number with equal success. For range and load-carrying ability, however, he maintained that the crescent and podded wings were better than the delta; for high altitude, take-off and landing, and for manœuvrability at height and at high air speeds, the crescent wing and the delta were better than the podded wing.

The crescent wing, he said, was chosen on performance grounds. The specification to be met had called for long range, good load-carrying ability, high subsonic cruising speed and high cruising altitude, but no one layout was right for every application. In general, a moderately high aspect-ratio would be required, with a high angle of sweepback to give the high critical Mach number. Unfavourable pitching behaviour at the stall, however, resulted from the use of high aspect-ratio

Handley Page Victor B.1 (four Armstrong Siddeley Sapphire).





Vickers-Armstrongs Valiant B.1 (four Rolls-Royce Avon).

and high sweep, tip-stalling problems becoming particularly acute.

The adoption of the crescent wing was essentially a working compromise between two methods of overcoming these difficulties—i.e., between high sweep with low aspect-ratio, and moderate sweep on a thin wing of reasonably high aspect-ratio. By progressively reducing both sweep and thickness/chord ratio, a constant critical Mach number along the span was obtained; the thick wing-root was suitable for stowage purposes; and the overall structure-weight penalty did not prove too great.

Handley Page interest in progressive reduction of sweep was first awakened in 1946. Early experimental evidence had shown that, in regard to behaviour at the low-speed stall, the three-stage-sweep configuration was better than one of constant sweep with high aspect-ratio. The highly swept root, which did not stall easily, resulted in a tip-stalling problem to some extent, but it was found that detail design of the wing/fuselage intersection could remedy this difficulty. Under high-speed stall conditions, the performance of the crescent wing showed to advantage, particularly good behaviour being apparent in high-g turns.

The need to vary the sweep and thickness/chord ratio to obtain the constant critical Mach number involved much calculation and experimental work in order to determine the pressure distributions and the most suitable wing geometry, and the Royal Aircraft Establishment co-operated in the necessary high-speed tunnel tests. Stability and control characteristics under conditions of unseparated flow were little different from those of a conventional swept wing of the same average sweepback angle. The sweepback reduction at the tip of the wing, however, had to be limited because of the danger of a loss of aileron effect. Nevertheless, aileron power at low speeds was an improvement over that of the straight swept wing.

From the aeroelastic point of view, the effect of swept wings on manoeuvre margin had to be considered. Up-loads at the tip, and consequent wing-bending, would normally increase the amount of wash-out and cause a loss of lift at the tips. While a small amount of this effect might be desirable, too much of it would result in excessively violent pull-outs at high speed, the manoeuvre margin becoming either too small or negative. A possible solution was to move the spar farther back to give a twisting effect in the opposite direction, but this was not practicable; neither was it permissible to increase the flexibility of the wing, due to flutter problems and the danger of aileron reversal. In the event, the twisting effect was largely overcome by the progressive reduction in sweep of the wing. As for flutter, no special characteristics were found which could be attributed solely to the shape of the crescent wing; in fact, general behaviour of the wing was similar to that of any swept wing.

It must be noted that, whereas Handley Page's technical director claims that the crescent wing is "the complete and only answer to the demands of a most exacting specification" the Boeing company, makers of the B-47 and B-52, hold it to be "a fancy wing, too heavy to be practical."

Design features of the Victor include "droop-snoot" leading edges—each in two sections—on the outermost panels; rearward-moving, trailing-edge flaps, shaped to the jet-nacelle contours; and large, hinged air-brake panels (mounted on the tail cone) to increase drag for deceleration in flight and on landing. Whereas what appears to be a visual-bomb-aiming position is built into the nose, this feature does not appear on either the Valiant or the Vulcan.

Early test flights showed the Victor to have a strong tendency to trim nose-up as ground effect came into play, thus conferring valuable "self-landing" characteristics. According to Handley Page's chief test pilot, any pilot can bring the Victor in gently with power on and with flaps and air brakes in operation, in rain or bad visibility; all that is required of him is to correct for local air disturbances affecting lateral trim until the wheels of the main bogie undercarriage touch down. Then the nosewheel is brought on to the runway and the brakes applied.

Vickers-Armstrongs Valiant B.2 (four Rolls-Royce Avon).

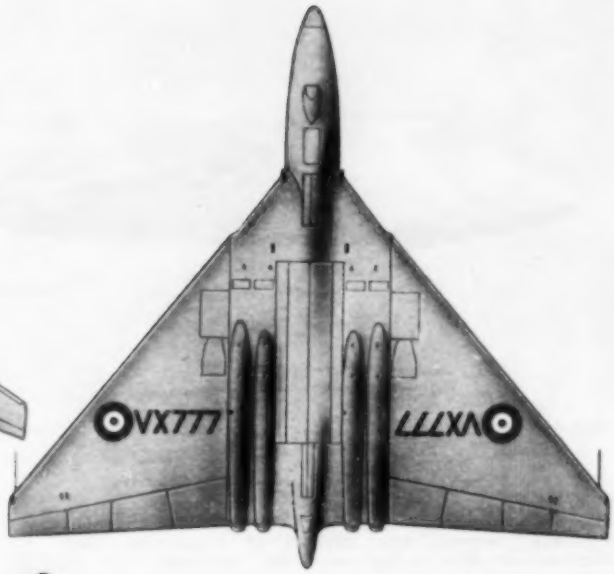
The Victor has powered controls, with progressive feel simulation.

Vickers-Armstrongs Valiant B.1. First of Britain's V-bombers, the Valiant B.1 (B.9/48) is a more conventional design than either the Vulcan or Victor, though it displays great ingenuity in general layout and detail treatment. The first prototype flew in May 1951, and the second in April 1952. Production machines are now being delivered to the R.A.F.

The Valiant's high-mounted wing is of generous area and of about 114ft span. Mean sweepback is about 20 deg and the four Rolls-Royce Avon turbojets are housed snugly in the inboard sections. There are no leading-edge slats or other attachments, but boundary-layer fences are fitted in line with the inboard ends of the ailerons. Double-slotted flaps extend outboard almost to the same position. Tail surfaces are slightly swept, and the nosewheel undercarriage has paired main wheels in tandem

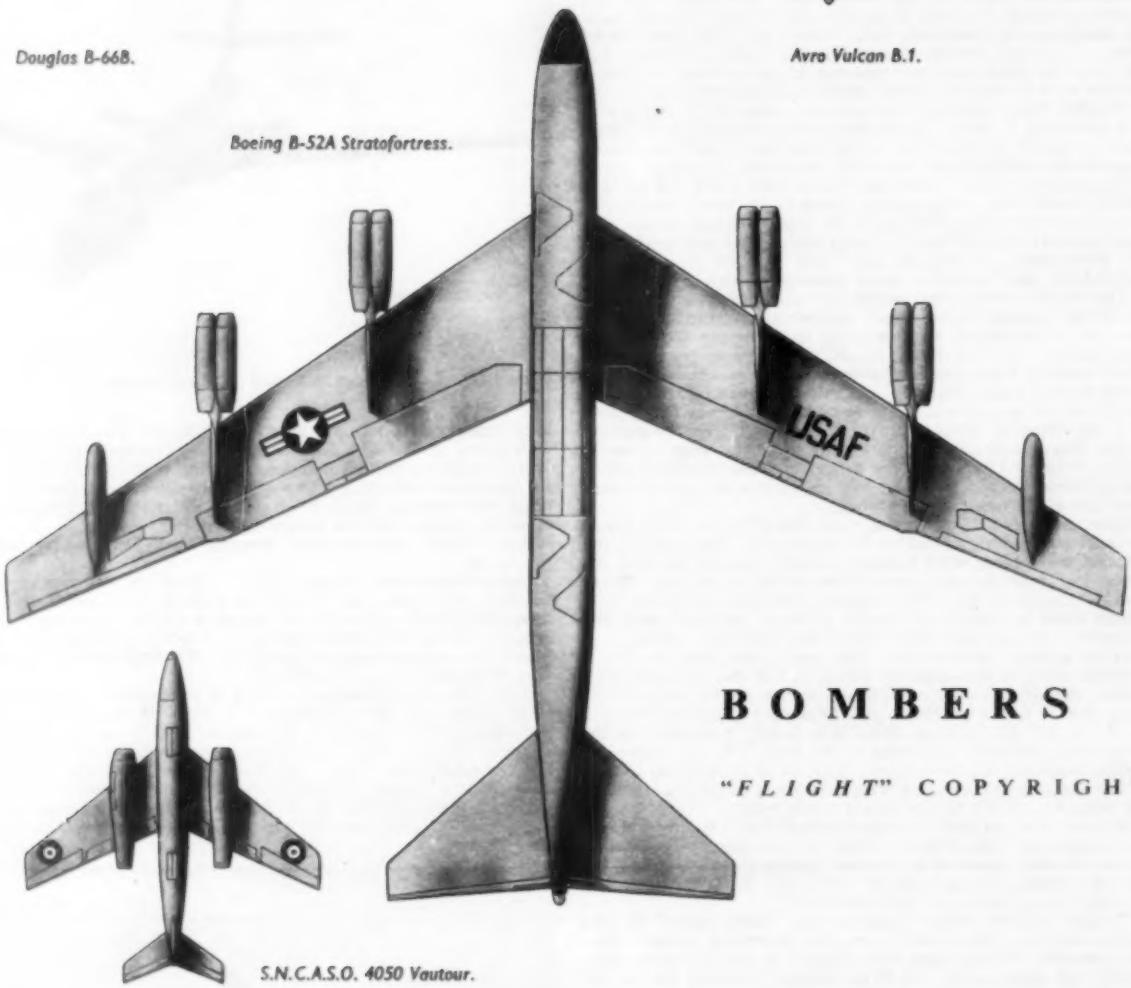
Very large Russian bomber, apparently with four turbojets.

Douglas B-66B.



Avro Vulcan B.1.

Boeing B-52A Stratofortress.



S.N.C.A.S.O. 4050 Vautour.

BOMBERS

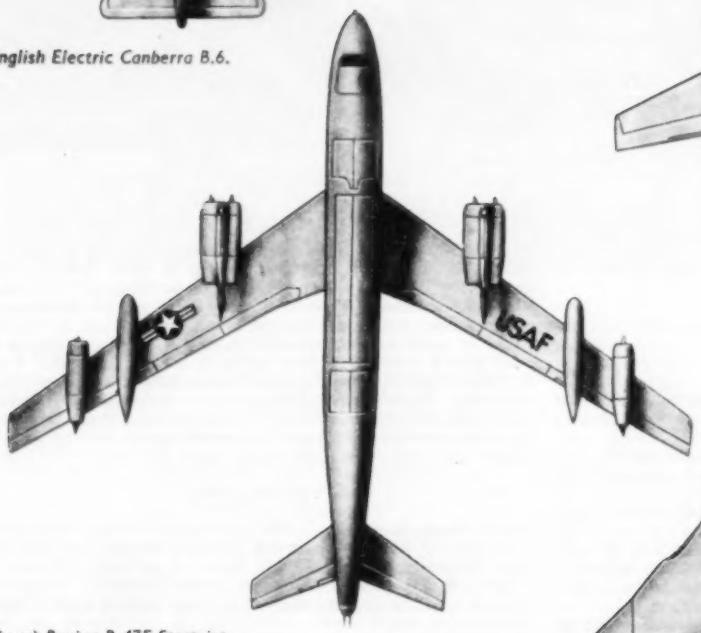
"FLIGHT" COPYRIGHT

IT was remarked in the introduction that present-day military aircraft display an amazing diversity in design, and nowhere is this more pronounced than in the case of bombers, the principal examples of which are here depicted to scale. It is especially interesting and edifying to compare the relative wing areas —particularly those of Britain's V-bombers (the Vulcan, Valiant and Victor) with the Boeing B-47 Stratojet. The superior high-altitude performance of the British machines can well be understood, though the Boeing is capable of operating at heights of the order of 40,000ft. Note, too, the various methods of disposing of

English Electric Canberra B.6.

Vickers-Armstrongs Valiant B.1.

(Below) Handley Page Victor B.1.



(Above) Boeing B-47E Stratojet.

TO SCALE

DRAWINGS BY BARRY JONES

the jet units—in buried installations in the larger British machines, and on underslung outriggers in the case of the two Boeings and the Douglas B-66B. Not the least remarkable fact which emerges from a study of these views is that the British bombers generally have a bomb bay of relatively greater area than the American machines, though depth, of course, must also be taken into consideration in computing capacity. Though the Vulcan is the only delta-wing bomber yet flying, the Convair XB-58 Hustler will be of similar plan-form, but will have a much thinner wing section, and, it is understood, "podded" jets.

Boeing B-47B (six General Electric J47-23). Extreme right, Boeing YB-52 (eight Pratt and Whitney J57).

Military Aircraft 1954

Bombers • MEDIUM & HEAVY

beneath the mainplanes, retracting outwards. Production machines have been flying with large auxiliary tanks beneath the wings, as shown in the photograph.

The B.1 is the standard production version for the R.A.F. and there has been no announcement that the B.2, subsequently described, will be issued to squadrons.

The second prototype Valiant B.1 was entered for—but not flown in—the England - New Zealand Race, and at that time it was disclosed that the power units were Avon RA.14s. It may be noted that the planned route consisted of only three stages—London - Karachi (4,192 miles), Karachi - Cocos Islands (3,255 miles), and Cocos Islands - Christchurch (4,929 miles).

The combination of four R.A.14s and low wing loading confer a remarkable take-off performance, and production aircraft are being flown from the 1,288-yd runway at Brooklands. It is known that one of these machines—lightly loaded, of course—was airborne in 600 yd in a light wind; thus, the claim that the Valiant is "a normal aeroplane capable of using ordinary bases despite the fact that it has a very high performance" is valid.

Vickers-Armstrongs Valiant B.2. This special development of the Valiant has been observed flying very fast and at very low level. It made its first appearance at the S.B.A.C. Display last year, and it was then noted that the fuselage nose was several feet longer and that trailing-edge fairings housed a new, rearward-retracting, twin-four-wheel-bogie main undercarriage. Possible camera ports were observed in the bottom skin, approximately in line with the leading edge. The power units—housed as in the Valiant B.1—are four Rolls-Royce Avon RA.14s.

RUSSIA

Soviet Heavy Bomber. The silhouette on page 839 shows a very large jet bomber which led the mass fly-past over Moscow's Red Square on May Day this year. Span seems to be 170-180ft, and gross weight is probably over 240,000 lb. If only four jets are fitted, as appears likely, these may deliver some 15,000 lb of thrust apiece.

This large jet machine is the only Russian long-range bomber positively identified apart from the Tu-4 (Russian-built copy of the Boeing B-29).

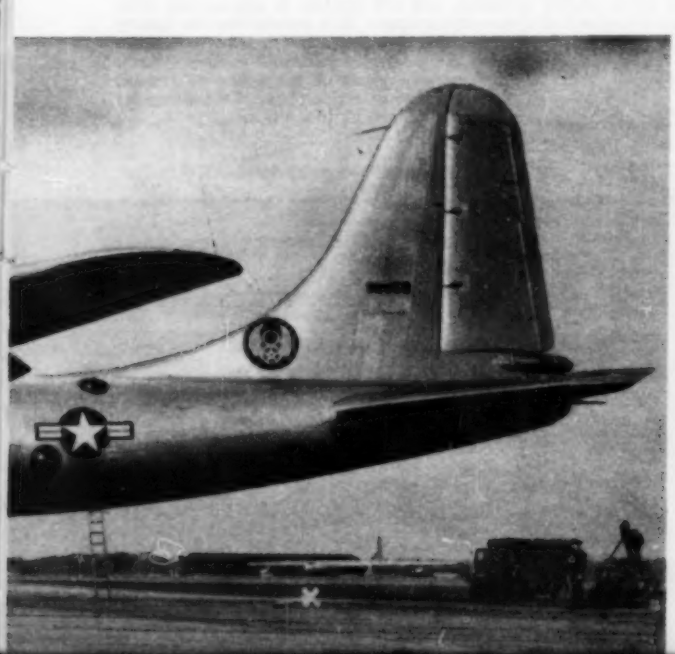
Convair B-36D (six Pratt and Whitney R-4360-41, and four General Electric J47).

U.S.A.

Boeing B-47E. Of the B-47—the latest production version of which is the "E"—General Gruenther has said, "We have one asset of tremendous value . . . the B-47, which can fly so fast and so high that there is no defence against it in this year of 1954." He added, "That plane can drop atomic weapons—and drop them accurately."

While the General's assertion that there is no defence against this bomber should not be taken too literally, it is nevertheless a very formidable weapon, and the knowledge that many hundreds are in service with the U.S.A.F. is indeed reassuring.

The B-47E is powered with six General Electric J47-25 turbojets and flies at weights up to 200,000 lb. A recent innovation is the fitting of 33 assisted take-off rockets, of 1,000 lb thrust each, in place of the original eighteen. Water injection has also been provided as standard. A retractable liquid-rocket installation—an alternative to the 33 x 1,000 lb assembly—is still experimental. A B-47 has been tested with the Bell B-63 Rascal controlled bomb (believed to be based on the design of the X-1 supersonic research aircraft, and to attain Mach 1.5 for final penetration over a 100-mile range), and another machine of the type has also been flown under remote control.



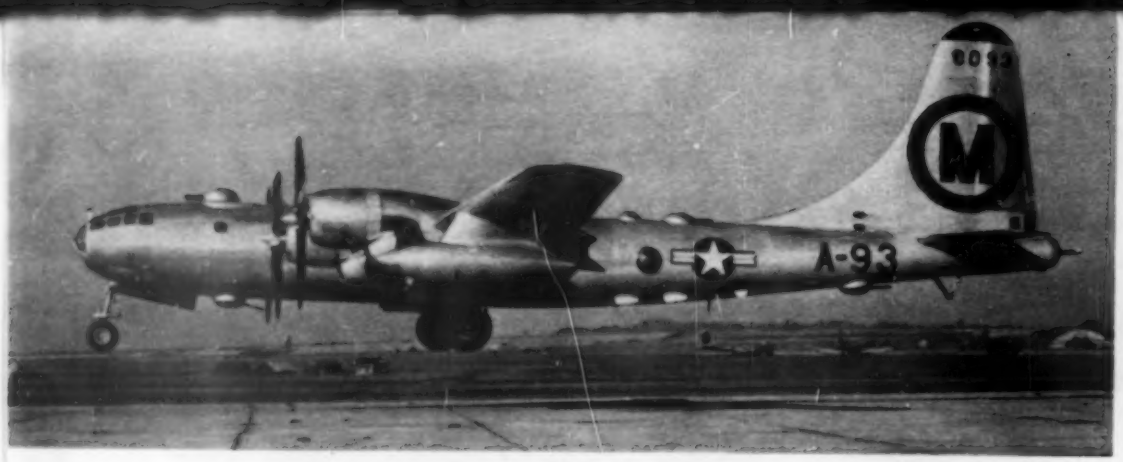
It was disclosed last month that the B-47E is equipped with a remotely controlled tail turret developed by General Electric and mounting two 20 mm guns. In danger areas the turret radar is switched to "search," and when an attacking fighter shows on the screen, it is automatically tracked until, having come within range, the guns automatically engage it.

Very few journalists have been permitted to fly in a B-47, and only one—the editor of *Flight*—has actually taken over control. His impressions will be the subject of a lengthy account in a forthcoming issue.

The B-47 carries an operational crew of three—pilot, co-pilot and navigator/bombardier. "The co-pilot," reports the Editor, "also looks after the tail gunnery and both pilots do some engineer work." He goes on, "The pilots' seats are in tandem, and low down on the left-hand side is a narrow passage through to the nose. Here a spacious station is provided for the navigator/bombardier, in which he is surrounded by the instruments of his trades. His seat revolves 'piedually' and has powered elevation control. It is also an ejector seat (or should it be 'rejector' seat, as it fires downward through a hatch). Both pilots' seats eject normally, and the rear or co-pilot's seat can be turned round—somewhat complicatedly—to allow him to examine the rear-turret radar and associated gubbins. . . . A sizable chute in the side of the fuselage calls for incidental mention; out of it flows—automatically—that radar counter-measure which we would call 'Window.' In America the gadget is the chaff-dispenser."

Although the B-47 is now very well established in service, it is worth recalling the 1,000-hr "shakedown" programme last year in which a B-47 flew more than 432,000 miles under simulated operational conditions. Mock attacks were made on many of the principal cities of the U.S.A., and 1,000 lb dummy bombs were dropped on a range from 40,000ft and above (Maximum bomb load of the B-47 is generally considered to be over 20,000 lb.) Extremely high speeds were recorded in jet streams; for instance, between Albuquerque and Wichita the aircraft maintained a ground speed of 794 m.p.h. for 30 min. Flights averaged 8½ hr each, but many lasted 12 or 13 hr, and the longest was 14 hr 25 min. Single flights well in excess of 3,000 miles were common without flight refuelling.

Boeing B-52A. A photograph on this page (actually of the YB-52 prototype) show that this great machine, which will replace the Convair B-36 as the standard heavy bomber of the U.S.A.F.'s Strategic Air Command, bears a very strong superficial resemblance to the earlier, smaller, B-47, though it has a



Boeing B-50D (four Pratt and Whitney R-4360-35).

Military Aircraft 1954

Bombers • MEDIUM & HEAVY

character all its own. The fuselage, in particular, is a relatively box-like structure and the wing is disproportionately greater in area than that of the B-47. Power plants are eight Pratt and Whitney J57s, in paired, underslung pods.

When the B-52 design was analysed in *Flight* of December 5th, 1952, it was remarked that the wing represented the solution to an extremely difficult set of design criteria, and that while a delta would undoubtedly have been a much easier structural proposition, the Boeing designers elected to pin their faith on "the devil they knew"—that is, a heavily loaded structure of extreme flexibility. The span is 189ft, aspect ratio about 9, and area about 4,000 sq ft. As on the B-47, sweepback is 35 deg. Skinning is of very heavy gauge, and no stress wrinkles appear in flight (as they most certainly do on the 156ft fuselage). Nevertheless, flexibility is very high—sufficient, in fact, to cause the ground anhedral angle of several degrees to become, at the tips, very noticeably dihedral in level flight. Angle of incidence is at least 7 deg, and thickness/chord ratio over 12 per cent at the root, though the remainder of the wing is much thinner. All primary bending loads—other than those taken by the skin—appear to be absorbed by a massive single spar at 50 per cent chord, stretching unbroken to the tip. A secondary spar further aft carries the flaps, but the remaining structure seems to consist solely of numerous chordal members normal to the leading edge. The main spar and the thick skin thus form a torsion-box to carry the very considerable twisting loads. Flaps are of modified Fowler type, and their inner sections move in towards the fuselage as they are lowered. The vast vertical tail surfaces are hinged to fold to starboard, where they lie parallel with the tailplane.

The unorthodox nature of the control system (which is manually operated), results from a number of abnormal and stringent demands. For instance, failure of the outer engine on one side of the aircraft could impart a yawing moment of unprecedented magnitude. Moreover, the structure, as we have already said, is unusually flexible.

The ailerons—each of which can move up or down independently—appear to be small surfaces mounted between the flaps; further lateral control is probably obtained by means of large spoilers mounted on the wing upper surface at about 65 per cent chord. It seems likely that the trailing-edge ailerons are used for normal purposes and are backed up by one or more sections of spoiler for emergencies. The spoilers act both by increasing drag and by destroying lift, and are probably brought into play in the case of engine failure (resulting in yawing) as well as in rapid rolling manoeuvres. The rudder is of astonishingly small proportions and is more akin to a trailing-edge tab, set in the vast fin.

The undercarriage is of "double bicycle" type, the port units retracting inwards and forwards, and the starboard units inwards and to the rear.

Gross weight, originally quoted as "over 300,000 lb," is now known to exceed 350,000 lb. Range may already be over 6,000 miles and might eventually be extended to 10,000 miles without recourse to flight refuelling. Although the prototypes have no provision for assisted take-off, liquid-fuel rockets may be provided for the possible 250 production machines. A 35ft braking parachute is standard equipment.

Production B-52As (the first of which left Boeing's Seattle plant in March) have side-by-side seating for pilot and co-pilot, in a largely redesigned nose, and carry external fuel tanks beneath the wing, beyond the outermost jet pods.

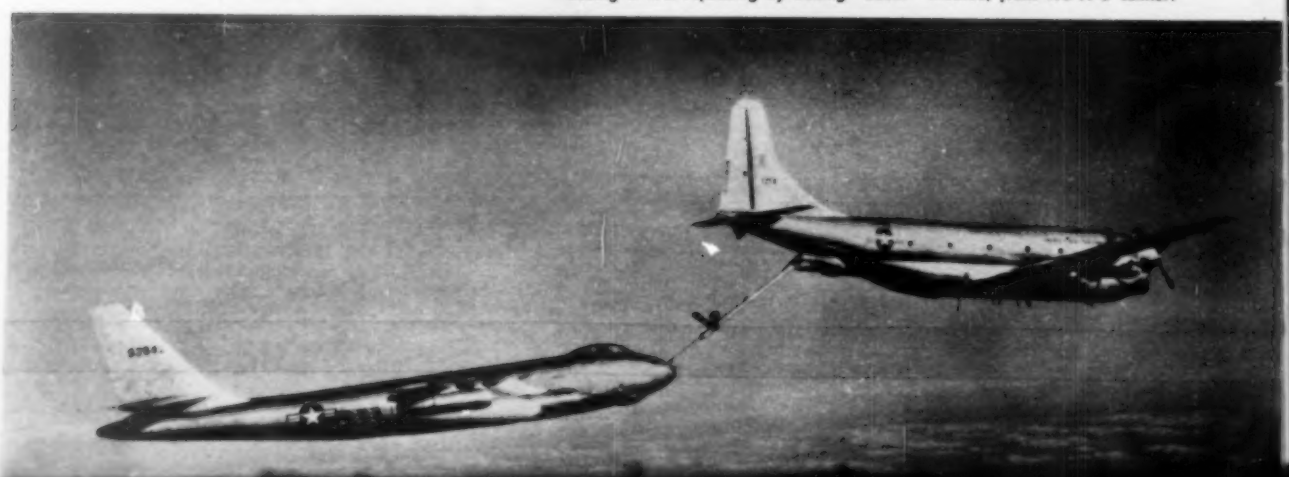
Boeing B-50D. The B-50D is probably the last piston-engined bomber to which we shall have occasion to refer in this series of reviews. Its all-round efficiency is probably considerably higher than that of the Russian Tu-4 (a copy of the B-29, from which the B-50 was developed); top speed is in the region of 400 m.p.h. at 25,000ft, ceiling about 40,000ft, and armament thirteen 0.5in guns. Span is 141ft 3in, length 99ft.

Convair B-36H. The "H" is the latest variant of the basic B-36 design in service and is powered with six Pratt and Whitney R-4360-53 engines and four General Electric J47 turbojets. The B-36H is a development of the "D", dealt with at some length in the preceding review (April 4th, 1952). Top speed is probably about 435 m.p.h. and service ceiling over 45,000ft.

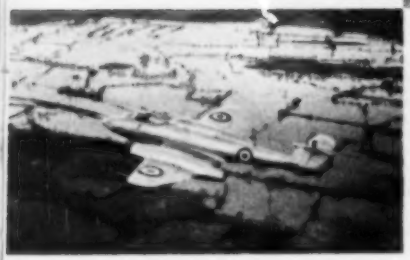
The latest sub-type is the B-36J, in the production of which a very great saving in man-hours has been effected.

Convair XB-58. The Hustler, as this machine is known, is likely to be the first supersonic bomber, and is regarded as the probable B-47 replacement. A prototype should fly in 1957. A delta, the Hustler may have "podded" General Electric J79s of about 15,000 lb thrust, and will operate in conjunction with the Douglas C-132 tanker/transport. It is known that the Sperry Gyroscope Company is providing the bombing and navigation system, Bendix Aviation the automatic pilot and control system, Emerson Electric the armament phase of the defensive system, and the Sylvania Corporation the detective phase of the defensive system. The undercarriage will retract into the wing.

Boeing B-47E refuelling by Boeing "boom" method, from KC-97G tanker.



(Right) English Electric Canberra P.R.3 (two Rolls-Royce Avon).



RECONNAISSANCE

In these days it is not necessary for air reconnaissance to be either visual or photographic; indeed, it is possible, by electronic means, to obtain valuable information, especially on radio and radar installations, without actually penetrating the territory of a potential enemy. Nevertheless, the reconnaissance camera remains an extremely valuable instrument of intelligence, for both tactical and strategic purposes.

In general, the long-range and medium-range reconnaissance aircraft is a derivative of the long-range medium or heavy bomber, and the short-range "tac. r" machine is similarly related to the jet fighter. No aircraft designed solely for reconnaissance is known to exist, though prototypes have been developed in the past and new specialized designs may well be seen in the future.

An apparently successful resuscitation of an old idea is the FICON system of the U.S.A.F., whereby a parasite Republic RF-84F is carried by a Convair RB-36. The RF-84F, while primarily intended for reconnaissance, could alternatively carry an atom bomb. It has also been suggested that the RB-36, if suitably equipped with search radar, could function as a picket aircraft, using the "parasite" for its defence.

The picket aircraft, incidentally, may fittingly be considered under the present heading. It is being increasingly developed and employed by the U.S.A.F. to carry powerful search radar to high altitude in order to provide early warning of incoming raids, including those by low-flying aircraft, and is foreseen as a fighter-director station. In this last capacity it would guide defending intercepters to their correct locality and height in relation to the approaching raiders, and might thus permit a simplification of radar equipment in the fighters themselves.

In the tactical field the need for visual reconnaissance remains, and it is British practice to arm the "tac.-r" aircraft so that they may operate in pairs, the leading pilot making the actual reconnaissance, whilst his companion keeps watch for enemy fighters.

Reconnaissance • LONG-RANGE

GREAT BRITAIN

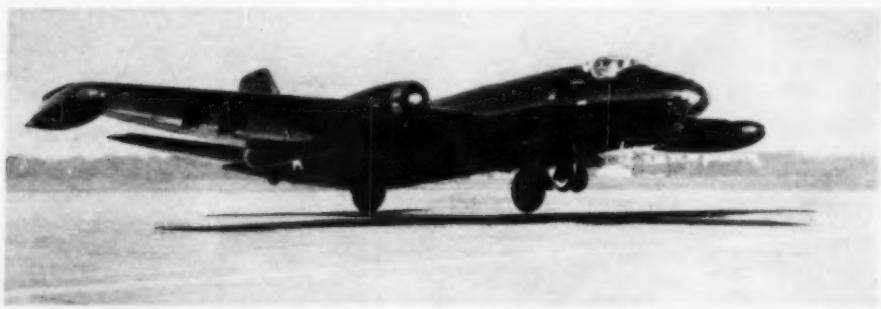
V-Bomber Adaptations. It is obvious that Britain's three V-bombers—the Vickers-Armstrongs Valiant, Avro Vulcan and Handley Page Victor—could readily be adapted for long-distance, high-altitude reconnaissance, though no reference to specific developments in this direction may yet be made.

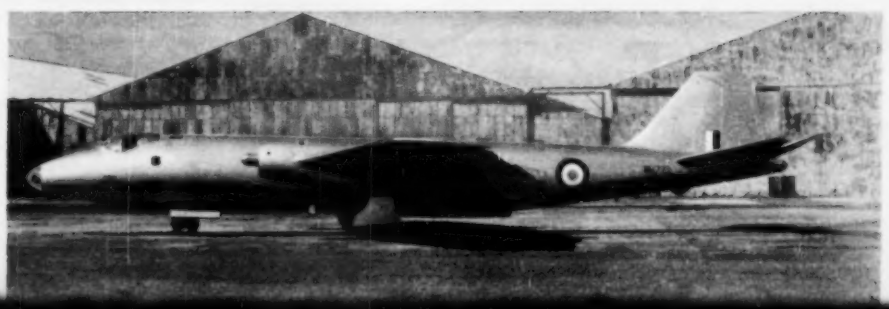
English Electric Canberra P.R. 3 and P.R. 7. Unlike the Canberra bombers, these photographic-reconnaissance variants carry a crew of only two. The P.R. 7 is distinguished from the earlier model in having later versions of the Rolls-Royce Avon and a longer fuselage.

At the beginning of 1953, a Canberra P.R. 3 reached Australia from England in an elapsed time of 22 hr at an average speed of 430 m.p.h. Average ground speed for the flight was about 500 m.p.h. Inspection of a Canberra P.R.3 suggests that provision is made for seven cameras. The world's altitude record of 63,668ft, standing to the credit of a special version of the Canberra powered with Bristol Olympus two-spool turbojets, is indicative of the altitudes potentially attainable by special P.R. developments.

U.S.A.

Boeing RB-47B and E. It was announced about a year ago that these two high-altitude reconnaissance versions of the basic B-47 were being delivered to the U.S.A.F. Whereas the RB-47E is built for reconnaissance from the outset, the "B" is a specially converted standard bomber which can be used either for reconnaissance or in its usual role. The chief differences between the RB-47E and the B-47E bomber include a longer nose and an





(Top) Martin RB-57 (two Wright J65). (Below) English Electric Canberra P.R.7 (two Rolls-Royce Avon).

Boeing RB-47E showing crew, cameras, flares and flash bombs.

Military Aircraft 1954

Reconnaissance • LONG-RANGE

air-conditioned camera compartment. A crew of three is carried, with the place of the observer/navigator/bomb-aimer taken by a photographer/navigator. Provision is made for 16 cameras (any seven of which can be carried at one time, depending on the mission), and for flares and flash bombs. Equipment includes intervalometers, which make it possible to take continuous pictures of large areas at regular intervals; an optical view finder; and photo-cell-operated shutters, actuated by the light of flash illuminants for night photography. An air-conditioning system in the camera compartment maintains uniform temperature and humidity, and keeps the camera ports free of moisture or frost. Little may be added concerning the RB-47E except that it operates at heights above 40,000ft.

The RB-47B has a convertible camera "package," made up as a unit and readily installed in, or removed from, the bomb bay. Modifications affect the bomb bay itself and call for the installation of special wiring; the hot-air ducting system is adapted to provide heat for the camera package. Conversion from the bombing to the photographic reconnaissance configuration requires only the removal of the bomb doors, attachment of the package to standard bomb door and bomb bay fittings, and connection of heating and electrical lines. The package is temperature-controlled and includes eight fixed cameras, which can be operated in groups, or as a battery.

Boeing RB-52. This reconnaissance development of the B-52 bomber (q.v.) is in production for the U.S.A.F.

Convair RB-36D/RF-84F FICON Combination. It may be recalled that soon after the war ended the McDonnell XF-85 parasite fighter was developed to fit into, and be released from, the bomb bay of a Convair B-36. Experiments with this particular combination were abandoned, but interest revived during 1952, with Republic Thunderjet F-84s as parasites. Later, special adaptations of the swept-wing F-84F were used, and it is an aircraft of this type which is now regarded as the standard reconnaissance fighter to be operated from the RB-36D long-range reconnaissance bomber. Known as the RF-84F Thunderflash, this has a radius of action of about 1,000 miles when fitted with drop tanks; the RB-36D has a radius of about 4,000 miles. Thus, the ultra-long-range performance of the RB-36 is teamed with the by no means despicable range, and very high over-target speed and altitude, of the Thunderflash.

The Thunderflash is carried on a steel-alloy yoke which is lowered from the B-36's bomb bay and consists of a U-shaped frame, with a straight beam extending from the bottom of the U. Mounted on the nose of the Thunderflash is a probe, not unlike that used with the flight-refuelling method, and the beam extending from the U-frame is equipped with a contact hole resembling that of the refuelling drogue. The Thunderflash makes contact by means of the probe, whereupon the U-shaped frame is lowered to engage with contact points on the fuselage. Frame and Thunderflash are then raised by hydraulic means.

It is known that the B-36 carries homing equipment to guide the Thunderflash pilot back to roost, and our contemporary *Aviation Week* mentions attempts to link the automatic pilot of the Thunderflash to that of the RB-36.

The Thunderflash carries a variety of cameras, radar and electronic equipment, and is distinguishable from the F-84F by its boundary-layer fences. Armament is four 0.5in guns.

Douglas RB-66A. This reconnaissance bomber, soon to be delivered to U.S.A.F. squadrons, is related to the B-66B bomber.

Lockheed RC-121C. Illustrated on page 847 this picket aircraft is the U.S.A.F. counterpart of the WV-2 (page 851).

Martin RB-57. A development of the basic B-57 bomber/intruder, this machine is now being delivered to the U.S.A.F.

North American RB-45C. A reconnaissance variant of the B-45 four-jet bomber, carrying five cameras.

Convair RB-36 taking aboard an experimental Republic F-84F using the FICON procedure described in the text.

Roy Nockolds' design to illustrate "Endurance", upon which depends the effective striking power of fleets at sea, the forewarning of attack . . . the safety of aircrews and their aircraft. Endurance is a factor which aircraft designers have long sought to reconcile with high performance; The Double Mamba turboprop has been designed to meet this requirement.

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Problems of flight

FOLDING WINGS

Folding wings have been used by beetles since evolution was young. Man, in the carrier-based aircraft, has faced only recently the problem that Nature solved so long ago.

There are nearly as many different reasons for folding wings as there are different kinds of beetle — and beetles, with their 250,000 species, are the largest order in the animal kingdom. Their habits vary widely. Some no longer fly; some never did. Those that do have heavier bodies than any other flying insect, because of their thick plates of protective armour. (Some also have enormous jaws: those of the male stag-beetle illustrated may be for fighting other males during the mating season, or perhaps for scraping plant-shoots to get at the sap.)

This great weight demands large wings. Hence Nature's problem. For many beetles burrow into the earth; many fight; many find their food or their safety in cracks in wood or chinks in stone. Unfolded wings would make all this impossible. And the beetle's wings are fragile. To keep himself airworthy he has to protect them under armoured covers. (These covers are actually his fore-wings, specially adapted for this special task.)

As in the crowded turmoil of the insect world, so in the tight space of an aircraft carrier. Man has taken yet another leaf out of Nature's great book—has found to yet another of his problems another time-honoured answer.

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North American RB-45C (four General Electric J47-GE-13 or 15). (Below) Lockheed RC-121C (four Wright Turbo-Compound R-3350).

Military Aircraft 1954

Reconnaissance • SHORT- & MEDIUM-RANGE

GREAT BRITAIN

Gloster Meteor F.R.9. The Meteor F.R.9 is the standard fighter/reconnaissance (tactical reconnaissance) aircraft of the R.A.F., and resembles the Mk 8 fighter, even to the extent of retaining the four 20 mm guns. The camera installation embodies a universal-mounting rack for a camera directed to port, to starboard or ahead. This mounting is so designed that the camera may be levelled horizontally, or depressed to an angle up to 14 deg, a usual setting being 12 deg depression. The camera itself is an F.24, usually with an 8in lens, but occasionally with a 14in alternative. The exposure windows on the port and starboard side of the fuselage nose are about a foot square, and there is a third window of about 9in diameter in the extreme tip. The camera is actuated by means of a positive-action switch near the power lever (this is not placed on the control column as the pilot's left hand is relatively free, and is usually kept on the power lever, whilst his right hand is gripping the control column, and perhaps a map also).

With two Rolls-Royce Derwent 8s the Meteor F.R.9 attains 585 m.p.h. at sea level, has an initial rate of climb of 6,950 ft/min, and a maximum range—with three drop tanks—of 950 miles. Take-off and landing runs are respectively 1,450ft and 1,500ft.

Gloster Meteor P.R.10. This machine is primarily intended for high-altitude operation, whereas the F.R.9 would generally spend most of its time at low level (although its cabin is likewise pressurized). The P.R.10 has the so-called long-span (43ft) wings and has one camera in the nose, as on the F.R.9, and one or more further aft in the fuselage. Its maximum range is 1,200 miles, and maximum speed at 30,000ft, 542 m.p.h. No armament is carried.

Vickers-Supermarine Swift F.R.5. The first prototype of this Swift development (which is apparently intended as a replacement for the Meteor F.R.9) is a converted Swift F.1, embodying a lengthened nose and having a taller fin, of increased area. A camera is mounted in the extreme nose and alongside is the combat camera. Lateral oblique-camera windows are covered by doors forward of the "elephant-ear" air intakes to the Rolls-Royce Avon turbojet.

SWEDEN

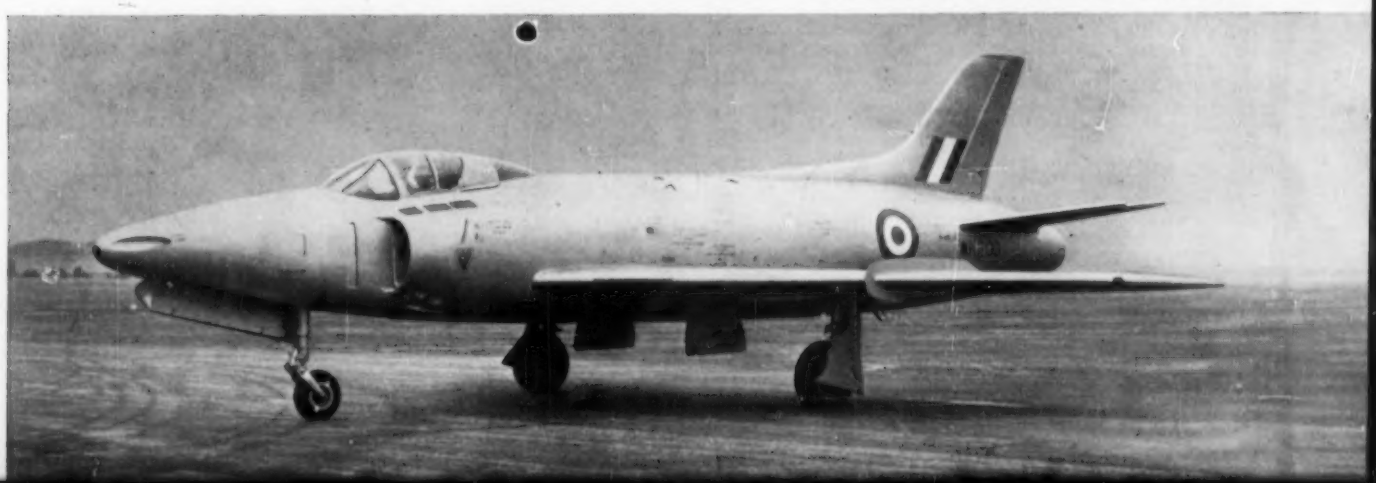
Saab S-29C. Reconnaissance machines of this type are already in service with the Royal Swedish Air Force. Provision is made for several different camera combinations, and as many as six automatic cameras can be installed for high-altitude or low-altitude work. Improved navigation equipment is also a feature.

U.S.A.

Grumman F9F-5P Panther. A long-range photographic reconnaissance development of the basic Panther for the U.S. Navy. Underwing, as well as wing-tip, tanks are normally carried.

Grumman F9F-6P Cougar. This reconnaissance develop-

Vickers-Supermarine Swift F.R.5 (Rolls-Royce Avon).



Republic RF-84F Thunderflash (Wright J65).

Military Aircraft 1954 | Reconnaissance • SHORT- & MEDIUM-RANGE

ment of the Cougar is powered with a Pratt and Whitney J48-P-8 of 7,250 lb thrust, weighs about 22,600 lb, has a range of some 1,600 miles, and is fitted as standard with a G-3 automatic pilot.

Lockheed RT-33. This single-seater is a much later development than its forerunner, the RF-80 tactical reconnaissance version of the original Shooting Star fighter, being developed, as the designation implies, from the two-seat T-33 trainer. It was, in fact, the success of the RF-80 in Korea which led to the decision to develop the new type—by the expedient of replacing the nose by a special fuselage section containing a battery of four cameras, mounted in the space formerly occupied by the six 0.5in guns and their belt boxes. The cameras provide a four-way coverage—vertically down, oblique right or left, or directly forward. A point of unusual interest is that a wire recorder is provided, to enable the pilot, while taking photographs, to pin-point the target verbally, and to record his position, altitude and distinguishing features of the terrain. Control panels in the forward cockpit have been redesigned to accommodate additional electrical equipment, and an automatic ejector seat, as in the F-94C Starfire all-weather fighter, is incorporated. Operational range is quoted as 20 per cent greater than for the standard T-33 trainer for the U.S.A.F.

McDonnell RF-101A. A photographic reconnaissance development of the F-101 twin-jet fighter, this type has already been ordered in quantity for the U.S.A.F. Pratt and Whitney J57-P-13 turbojets are specified.

McDonnell F2H-2P Banshee. In the longer, heated, nose of this Banshee development—a standard type in service with the U.S. Navy—is provision for six different types of camera. The pilot not only operates the cameras, but orientates them also. Using a CA-8 cartographic camera, an experimental Banshee has secured pictures of Washington from heights of the order of 48,000-51,000ft.

McDonnell F3H-2P Demon. A special reconnaissance development of the F3H-2N all-weather, single-seat fighter ordered for the U.S. Navy, this machine will probably be powered by the Pratt and Whitney J57.

Republic RF-84F Thunderflash. The Thunderflash has already been dealt with as a parasite, air-launched, strategic reconnaissance machine, but it is, of course, eminently suitable for normal tactical reconnaissance, and is in production for the U.S.A.F. in that guise.

Republic F-105. It is understood that a reconnaissance version of this very fast, Allison J71-powered, fighter is foreseen by the U.S.A.F.

(Top) McDonnell F2H-2P (two Westinghouse J34). (Centre) Saab S-29C (D.H. Ghost). (Below) Nose of Lockheed RT-33 (Allison J33.)

Avro Shackleton M.R.2 (four Rolls-Royce Griffon).

Military Aircraft 1954

MARITIME RECONNAISSANCE

Segregation of these aircraft from the foregoing land-based reconnaissance types was decided by two considerations: their peculiar field of over-water employment, and the extensive provision invariably made in their design for anti-shipping weapons. Not surprisingly, they will be seen to contrast sharply with the other reconnaissance types in having piston engines or turboprops (for a primary requirement is endurance at low or medium levels); and a number of them are flying-boats.

Just as radar picket aircraft were earlier considered as long-range reconnaissance machines for the use of land-based forces, so here will similar aircraft be dealt with in relation to naval forces.

There is, however, a single specialized type—the Martin Seamaster jet-propelled, mine-laying flying-boat—which in reality is a shore-based strike aircraft and more closely related to the jet bomber than to current maritime reconnaissance types, though it is considered under this head.

GREAT BRITAIN

Avro Shackleton M.R.1, 2 and 3. The first protoype of the Shackleton M.R.1 flew early in 1949. It was powered with—like subsequent models—four Rolls-Royce Griffon engines, and was intended to be armed with two forward-firing 20 mm guns, in remotely controlled barbettes on each side of the nose; two more in a Bristol turret in the dorsal position; and two 0.5in guns in a Boulton Paul tail turret. Production M.R.1s, however, have neither nose nor tail armament.

Originally it was stated that a tail-wheel undercarriage was chosen in order to obtain the maximum utilization of the space available in the nose for operational equipment, and that stowage of weapons was also facilitated by this arrangement. It will be noted, however, that the new M.R.3 version has a nosewheel undercarriage.

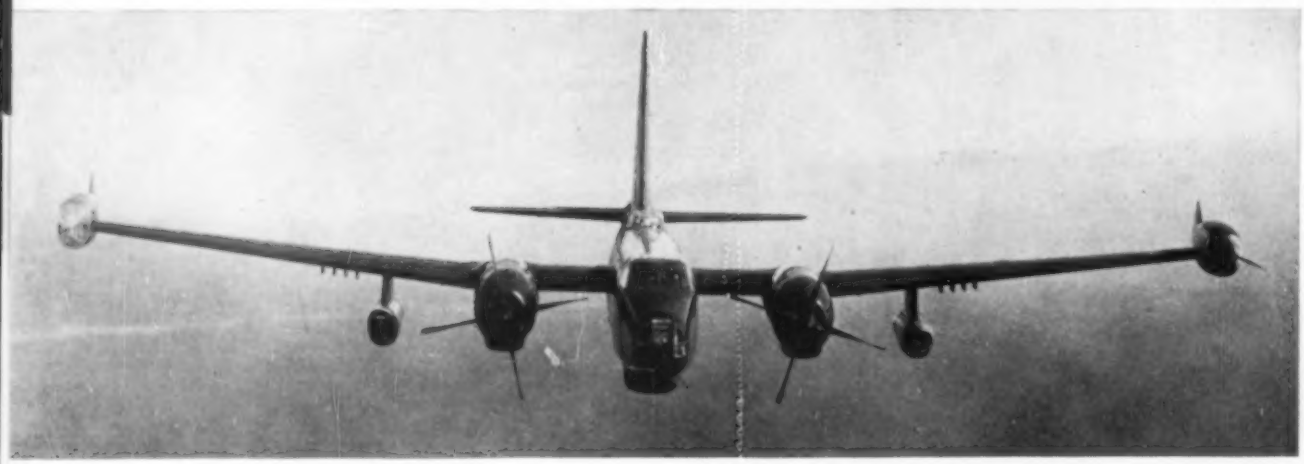
The Shackleton M.R.2 is essentially similar to the M.R.1 and is operationally interchangeable. Externally, obvious points of difference include the longer nose and tail, transference of the radar scanner from the nose to a ventral position, provision for nose-mounted 20 mm guns, and rearranged ancillary equipment.

Technical data for all Shackleton variants are restricted, but the following extracts from an account of an ocean patrol in an M.R.2 written by a member of *Flight's* staff and published on January 29th this year is illuminating.

"We walked under the nose and into the open bomb bay, the doors of which reached almost to the ground; with spotless white walls, it suggested a hospital operating theatre, and varicoloured weapons of all sizes hung from carriers in the 'ceiling.'

(Left) Tank model of Saunders-Roe maritime-reconnaissance flying-boat. *(Below) Short Sunderland 5 (four Pratt and Whitney Twin Wasp).*

Lockheed P2V-5 Neptune (two Wright R-3350-30W Turbo-Compound). (Below) Lockheed P2V-5 Neptune (two Wright R-3350-30W Turbo-Compound and two Westinghouse J34).



Military Aircraft 1954 | Maritime Reconnaissance

Although this ceiling is fairly close to the ground, access for personnel and trolleys is unobstructed.

"For an aircraft designed for such a variety of offensive roles, there are very few excrescences—some clusters of stick aerials, a mid-upper turret, and the almost completely retracted radome . . .

"The main crew-positions are grouped round the wing centre-section—an area which is noisy but comparatively free from vibration. The seats are large, and many of them swivel; the back-rests are adjustable for height, and all are fitted with deep, soft cushions. One noted that long safety-harness straps were fitted on both wing spars where they passed through the fuselage, allowing the crew to strap in at ditching stations. The nose gunner's position in the Mk 2 is provided with a large swivel seat, which may possibly be modified when the two 20 mm cannon are fitted. . . Although at first there appeared to be little space for movement, experience during the flight showed that it was possible for as many as five people to watch the navigator's table at the same time. The navigator's position is, in fact, spacious and well-ordered.

"Hot meals can be prepared on an electric galley in flight, and two large bunks allow comfortable sleep for those off duty. The nose and after-fuselage sections, too, are spacious and have full head-room, making it possible for resting crew-members to stretch their legs and relax away from their working positions.

"From the pilots' point of view the Shackleton is admirable. Only flying instruments and controls and basic engine instruments (revs and boost) confront them. The engineer supervises fuel gauges and flows, engine starting, and the other processes which lie in his sphere of activity. The Griffons are virtually independent, being almost entirely automatically regulated. They roar obediently for hour after hour, seeming to require no attention at all. The flying controls are responsive and positive, and the trimmers ready to hand and sensitive. Everything is reduced to a logical and orderly simplicity."

The Shackleton M.R.3, as now in production for Coastal

Lockheed WV-2 (four Wright R-3350 Turbo-Compound).

Command and for the South African Air Force, is characterized, as already mentioned, by a nosewheel undercarriage. Other alterations include a new cockpit canopy, affording a wider field of vision; extensive soundproofing; better interior furnishing—particularly in a new "wardroom" for off-duty crew; and additional fuel tankage, some of it, apparently, at the wing-tips. Like earlier Shackletons, the M.R.3 will carry a lifeboat as an alternative to its very heavy and bulky load of offensive weapons.

The Shackleton M.R.2 measures 120ft in span and is 87ft 4in long.

Saunders-Roe Flying-boat Project. A Saunders-Roe design study for a long-range ocean patrol flying-boat, prepared over two years ago, showed a gross weight of 150,000 lb and an ultimate range of 8,000 miles at 400 m.p.h. It was suggested that, in addition to carrying radar and sonobuoys for the detection of submarines, such an aircraft might lie to a sea anchor and utilize sub-surface detection methods. A recent tank model of such a flying-boat is shown on page 849.

Short Flying-boat Project. One Short proposal for a long-range military flying-boat would be about 110ft long and might have a radar nacelle in the hull, aft of the step and clear of the water-line, so that it could be retracted when not in operation. There would be bow, stern and mid-upper gun positions, and offensive weapons would be carried in the hull, whence—as on the Sunderland—they would be transferred outboard.

Short Sunderland. The first prototype of the Sunderland flying-boat flew 17 years ago, but the type continues in service as a dependable and efficient maritime reconnaissance machine. Reconditioned Sunderlands supplied to New Zealand have two inter-communication systems, the second of which links the members of the anti-submarine team. Individual members of the team can select either this system or listen on the main circuit.

U.S.A.

Lockheed WV-2. This is a radar picket and countermeasures aircraft developed from the civil Super Constellation and now in production for the U.S. Navy. In the picket role the WV-2 carries very powerful search radar to high altitudes, where the equipment attains its maximum effectiveness in the spotting of far-off objects. Should the enemy approach under the beam of normal radar, the WV-2 can pick him up far beyond present detection zones, and by the use of UHF radio can transmit details of strength, direction, height and speed to defending intercepters. The height-finding radar antenna—8ft tall—is mounted on top of the fuselage, and the "guppy" bulge beneath the fuselage carries "devices to detect the speed, strength and direction" of approaching raiders whether these are in the air or on the sea.

The economy of the Wright Turbo-Compound engines, and the addition of wing-tip tanks to the already extensive internal tankage, enables the WV-2 to patrol for extremely long periods, and accommodation is provided for a crew of 31. Bunks are convertible to couches and the galley has a refrigerator, running water and grills.

Span, 123ft; length, 113ft 6in.

Lockheed P2V-5, -6 and -7 Neptune. These three Neptune variants are the latest of a long series. The -5, known in the R.A.F. as the Neptune M.R.1, has a mixed, turretted armament of 20 mm and 0.5in guns, and is believed to carry, as typical offensive loads 12 × 325 lb depth charges, 16 × 500 lb bombs, mines or torpedoes. Provision is made under the wings for rocket projectiles. An external radome is a normal fitment, and provision is made for magnetic detection equipment in the extreme tail.

The -6 is equipped with special reference to mine-laying, but has numerous other modifications, and the -7 is a lighter model with provision for two Westinghouse J34 turbojets beneath the wings. In conjunction with a lower all-up weight, these are said to reduce the take-off run by 30 per cent and to add 50 kt to maximum speed. The jet units use the same high-octane aviation fuel as do the two Wright R-3350-30WA Turbo-Compound piston engines, and their "pods" are quickly detachable, each being held in place by only three bolts. Other design changes in the -7 are an entirely new forward fuselage, with enlarged "work area," and a redesigned bubble canopy. Electronics equipment totals more than a ton-and-a-half.

Martin P5M-2 (two Wright R-3350 Turbo-Compound).

A member of *Flight's* staff who flew a P2V-5 described his experiences at length in the issue of October 30th, 1953. He reported: "All on board thought highly of the Neptune's specialized equipment for their own particular duties, and of its general comfort and performance. On long trips, a folding stretcher-type bunk can be let down from the port side of the forward fuselage, above the entrance hatch and abeam of the positions of the radar operator and the navigator. The radar equipment is extensive; beneath the fuselage is the massive radome housing the search radar installation, while 'other radar units' are contained in the wing-tip nacelles. The forward end of the starboard nacelle contains in addition the powerful (70-million candlepower) searchlight for low-level oversea duties."

The Neptune P2V-5 has a span of 104ft and is over 78ft long.

Martin P5M-1 Marlin. It has been claimed for this twin-engined, gull-wing flying-boat that it carries the most powerful tactical radar of any aircraft in service with the American forces. The crew numbers seven, and in addition to radar there is magnetic detection equipment and provision for sonobuoys, searchlights and cameras. The power plant is two Wright R-3350-30W Turbo-Compound. Stowage is provided externally, and in the nacelles, for bombs, mines, depth charges, rocket projectiles or torpedoes. Empty weight is nearly 37,000 lb and gross weight nearly 73,000 lb. Patrol duration is up to 20 hr.

Span, 118ft; length, 95ft.

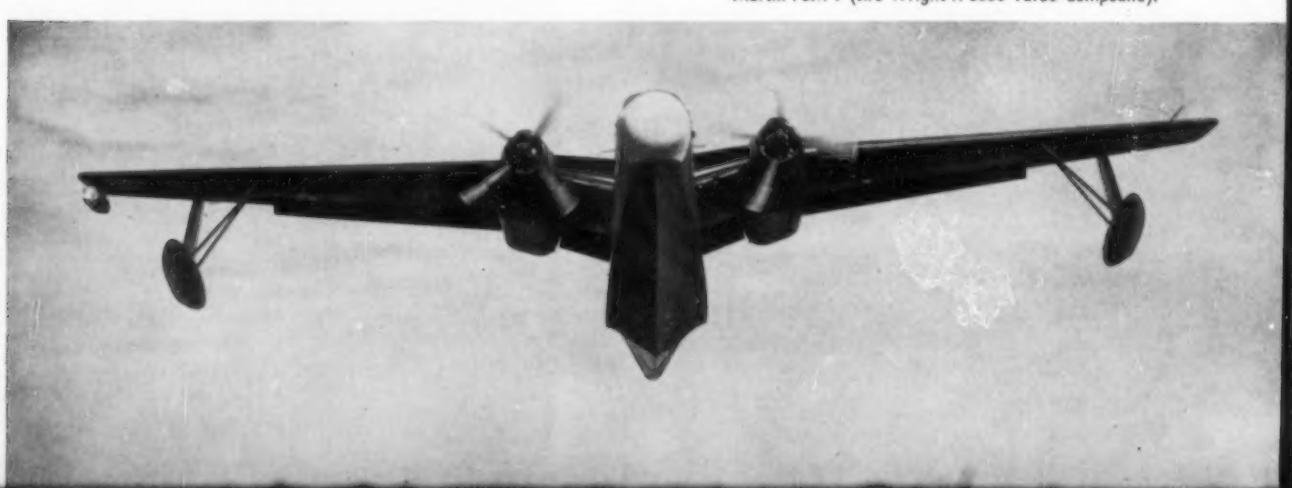
Martin P5M-2 Marlin. This Marlin development is distinguished from the P5M-1 by the mounting of the horizontal tail surfaces on the extreme tip of the fin, and by the lowering of the bow chine to reduce the height of spray generated during water manoeuvres, especially take-offs. The engines are R-3350-32W Turbo-Compounds, giving greater range and higher speed, and allowing heavier take-off weights. Crew comfort is of a higher order than formerly.

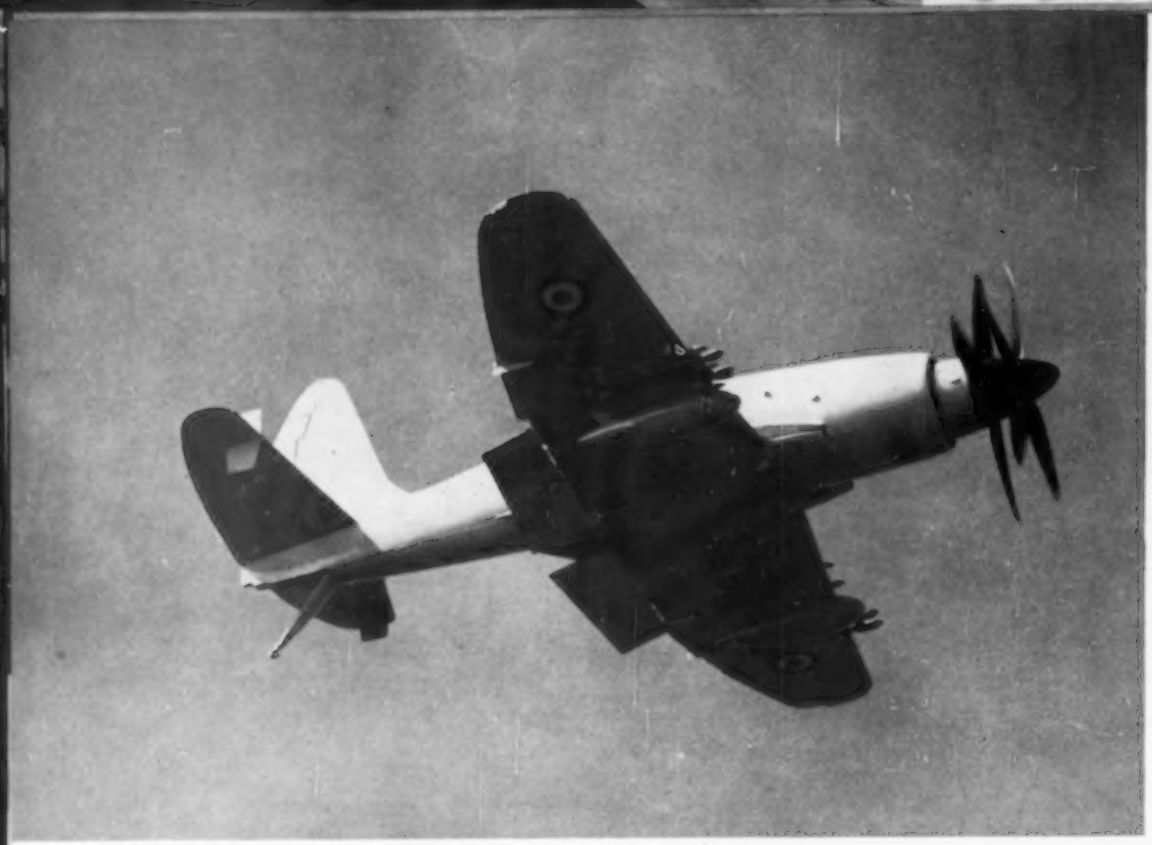
Martin XP6M-1 Seamaster. Primarily intended for long-range mine-laying, this aircraft could also be used for reconnaissance, for patrol or as a tanker. It is to have four Wright J65 turbojets and should cruise at some 600 m.p.h. Ultimate range is expected to be about 3,000 miles, and provision is made for over 28,000 lb of mines, bombs or other weapons. As a tanker the Seamaster could carry three Flight Refuelling hose units and over 4,000 U.S. gallons of transferable fuel. A T-tail, as on the P5M-2, is likely to be a feature.

CANADA

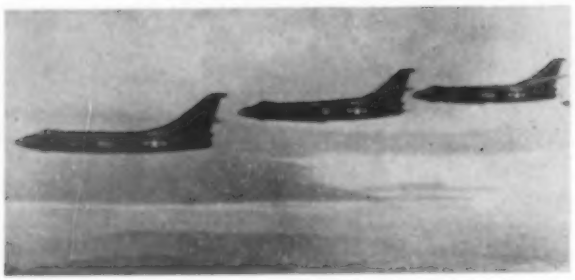
Canadair/Bristol M.R. Britannia. An agreement between the Canadian Government and the Bristol Aeroplane Co., Ltd., covers the manufacture of maritime-reconnaissance versions of the Britannia by Canadair, Ltd., who will undertake the necessary redesign. Wright Turbo-Compound engines will be installed.

Martin P5M-1 (two Wright R-3350 Turbo-Compound).





Westland Wyvern S.4 (Armstrong Siddeley Python).



Military Aircraft 1954

CARRIER-BORNE STRIKE

Though modern carrier-borne fighters are generally capable of delivering respectable loads of bombs, rockets and other offensive stores (it has been officially stated that the Supermarine 525 development will carry the atom bomb if required), the specialized strike aircraft still retains its identity, as shown by the examples here reviewed. Indeed, in this category the U.S. Navy has a very ambitious programme, involving the heaviest and most formidable machine ever designed for carrier operation—the twin-jet Douglas Skywarrior. This massive machine carries atomic weapons, and can attack from very high, as well as very low, levels.

GREAT BRITAIN

Westland Wyvern S.4. The "S" in the designation of this massive single-seater signifies "strike," having supplanted the former "TF," denoting a torpedo/fighter. The Wyvern is unique in being powered with the Armstrong Siddeley Python turboprop, driving an eight-blade Rotol contra-rotating airscrew. It is armed with four 20 mm wing-mounted guns and can carry a torpedo, bombs, rocket projectiles, mines or depth charges. The inner wing has Youngman hydraulically operated flaps, and there are dive brakes on the outer panels. The pilot, who has a Martin Baker ejection seat, is placed unusually high, and is thus afforded an extensive field of view for deck landing.

Details of loads and performance are restricted, but a Python-powered Wyvern has been publicly flown with a torpedo in addition to 16 rocket projectiles and has shown a high standard of manœuvrability. The original piston-engined Wyvern T.F.1 attained 455 m.p.h., and it may be assumed that the S.4 has a superior performance.

Span, 44ft; length, 41ft 10in.

FRANCE

Breguet 960 Vultur. In order to reconcile in this aircraft endurance at low and medium levels and high performance at all altitudes, the designers chose a mixed power plant—an Armstrong Siddeley Mamba turboprop in the nose and a Rolls-Royce Nene

Breguet 960 Vultur (Armstrong Siddeley Mamba and Hispano Nene).

Douglas AD-5 (Wright R-3350-26W).

turbojet at the rear. The first prototype—the 960-01—flew in the summer of 1951 and has a variable-speed Mamba 1, while the later 960-02, first tested about a year later, has the more powerful, constant-speed, Mamba 3. The constant speed characteristic, it may be noted, is valuable in a carrier-borne aircraft in permitting rapid opening up for "going round again." It is also a feature of the Python-powered Wyvern.

The crew of two sit side by side in the Vultur, under a roomy, aerodynamically clean enclosure, and have Martin-Baker-type ejection seats. A typical offensive load is a single weapon of 1,000 kg, carried externally under the fuselage, and eight rocket projectiles beneath the wings. There are no guns and no internal weapons bay. Strike radar is located in the starboard wing-tip "tank" (a similar container on the port wing is a genuine fuel tank), and if required search radar can be disposed under the fuselage.

On the occasion of the visit of Vultur 02 to the Royal Aircraft Establishment a member of *Flight's* staff was privileged to witness trials and reported: "Take-off was rapid and the wheels were up ten seconds from the start of the run . . . The overwhelming impression was that the airscrew was being pushed through the air by the Nene and was a hindrance to progress. Actually, the Rotol four-blader does its fair share under all conditions. It is constant-speeding even at 460 kt, at which speed the pitch angle is over 60 deg . . . performance is undoubtedly high . . . Approach is made at about 100 kt, and is very steep."

Data for the Vultur 960-02, with Mamba 3 and Hispano-Suiza Nene 104, are: span, 54ft 3in; length, 43ft 4in; all-up weight, about 23,000 lb; max. speed, 555 m.p.h.; cruising speed (Mamba only), 230 m.p.h.; landing speed, 93 m.p.h.; endurance (Mamba only), 4 hr; absolute ceiling, 42,000ft.

U.S.A.

Douglas AD-4, -5 and -6 Skyraider. These are the most recent Service-type developments of the very extensive Skyraider family—one of the most versatile and useful ever propagated. The AD-4, which marked the end of a progressive structural strengthening programme, was fitted with a P.1 automatic pilot as standard, and included new radar equipment and a redesigned cockpit. A minor variant, known as the AD-4B, has been modified to carry special weapons; the AD-4N is a development for night attack; the AD-4Q has countermeasures equipment; the AD-4W three-seater has special search-radar for submarine detection or early warning; and the AD-5S is for anti-submarine strike.

Known as a "multiplex" aircraft, the later AD-5 is a "twelve in one" machine, making use of packaged conversion kits. Attack by day or night, early-warning, anti-submarine search and strike, photographic reconnaissance, target towing, ambulance work and transport are possible roles. (In this last connection it may be noted that, although the Skyraider was designed as a single-seater, ten men can be carried in addition to two in the cockpit). Under the present heading, however, we are principally concerned with the Skyraider as a strike aircraft, and in this role it carries a fixed armament of two 20 mm guns in addition to two 11.75in Tiny Tim rockets, two 2,000 lb bombs, two 2,150 lb torpedoes, or varied loads of mines, depth charges, smoke containers, searchlights, or packaged machine guns. Twelve small wing pylons carry either twelve 5in rocket projectiles or the same number of 250 lb bombs. In the Korean campaign loads of 8,000-9,000 lb were not uncommon, and an AD-4B is known to have lifted a gross load, including fuel ammunition, of 14,941 lb—some 3,000 lb more than its own basic weight. The maximum speed is probably of the order of 350 m.p.h., and initial rate of climb over 2,500 ft/min. Span is 50ft and length 39ft 3½in.

Douglas XA2D-1 Skyshark. Although only a few of these aircraft are being built, the type is nevertheless of interest, if only for comparison with the British Westland Wyvern. The XA2D-1 is powered by an Allison XT40-A-6 twin turboprop of

(Left) Douglas AD-4 Skyraider, with three 500 lb bombs and twelve rocket projectiles. (Right) Douglas A4D Skyhawk (Wright J65).

Douglas XA3D Skywarrior (a prototype, fitted with two Westinghouse J40, is shown).

Carrier-borne Strike

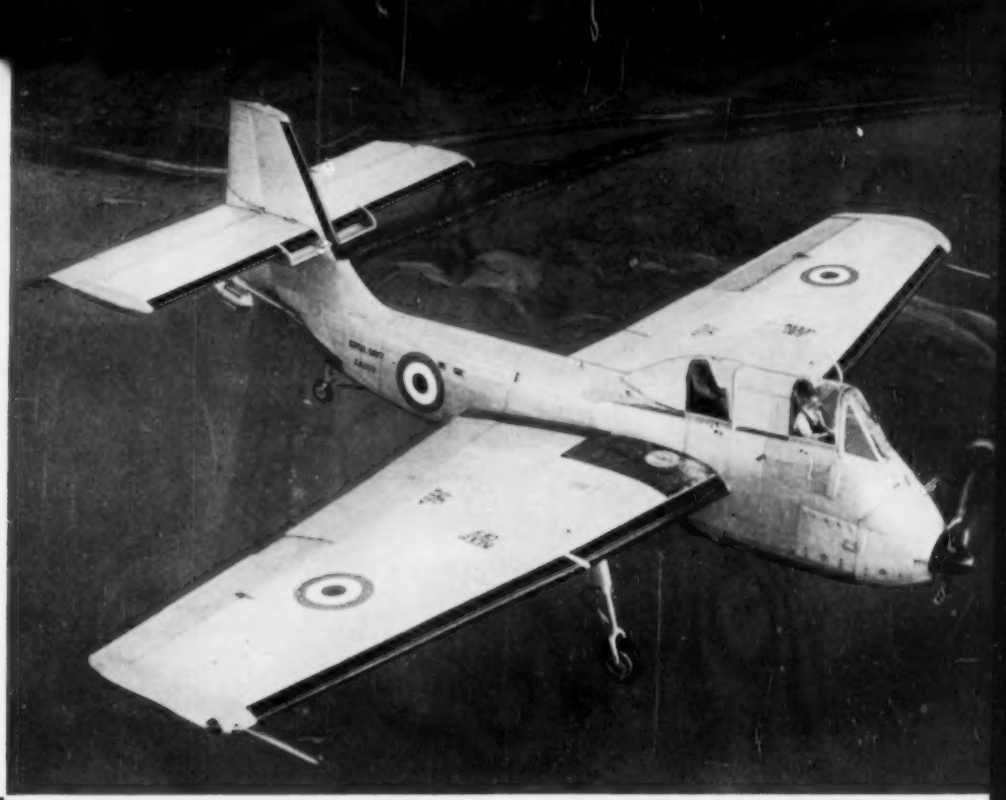
5,500 e.h.p., driving two three-blade Aeroproducts co-axial, contra-rotating airscrews through a common gear-box. Endurance may be protracted by shutting down one of the two units, as in the Double Mamba-powered Fairey Gannet, described under *Ship-Borne Anti-Submarine*. The power plant being partly below the cockpit, the pilot is placed well forward and has an excellent view over the nose. Built-in armament is four 20 mm guns, and external provision is made for three streamlined 2,000 lb bombs (with which the aircraft is 50 kt faster than with three of the earlier, more crudely designed, bombs), or the same number of Tiny Tim rockets, torpedoes or fuel tanks of 150 or 300 U.S. gallons. Provision is made outboard for eight rockets.

Douglas A3D Skywarrior. This very notable carrier-borne strike machine is primarily a bomber, but is suitable for high or low-level attacks with a wide variety of weapons, including torpedoes. Considerably larger than the Canberra, it is nearly twice as heavy, and is intended for operation (in conjunction with the British-developed steam catapult) from the new *Forrestal* class carriers. It has a high-aspect wing and is powered, in production form, with two Pratt and Whitney J57-P engines. The wing and the vertical tail surfaces fold hydraulically. A point of incidental interest is that, except for an electric tail-trimming jack, the Skywarrior uses all-hydraulic auxiliary power. The various pumps and generators are mounted on one big gear-box in the fuselage, driven by an air turbine supplied by compressor-bleed air. In addition to the usual advantages of this arrangement, the turbine and gear-box are accessible from the crew compartment, so that the various valves and switches can be operated manually. A slide-type escape chute—similar to that used in the F3D Skyknight—is built in. The internal weapons bay is said to carry "the largest-type bombs, torpedoes or other munitions the Navy is expected to utilize in striking actions from carriers" and defensive armament is two 20 mm remotely controlled guns, in a tail barbette. Speed is well over 600 m.p.h.

Douglas A4D Skyhawk. A delta-wing strike aircraft of exceptional interest, the Skyhawk is so small that its wings—of 26-28ft span—do not fold for carrier stowage; and it is lighter than many present-day shore-based fighters. The power plant is a Wright J65-W-2, and supersonic speed will be attainable in the dive, though not on the level. Construction—of aluminium-alloy—is very light, and the A4D is claimed to fly faster, over longer distances, and with a more powerful strike load than any other aircraft of its class. Radius of action is said to be greater than for present piston-engined attack machines, and operation should be possible from all sizes of U.S. Navy carriers and from short landing fields.

North American AJ-1 and AJ-2 Savage. In these heavy, multi-seat, multi-engined aircraft is seen the germ of the Skywarrior formula, though the power plant is two Pratt and Whitney R-2800 Double Wasp piston engines plus one Allison J33-A-10 turbojet. Early Savages are now used as tankers. In the attack role a bomb load of about 10,000 lb can be carried.

North American AJ-1 Savage (two Pratt and Whitney R-2800-44W and Allison J33-A-10).



Short Seamew A.S.1 (Armstrong Siddeley Mamba).

Military Aircraft 1954

SHIP-BORNE ANTI-SUBMARINE

The term "ship-borne" was deliberately used in preference to "carrier-borne" in view of the possibilities now opened up by the helicopter of operating from other vessels—even the smaller types of merchantmen. Development of anti-submarine helicopters has lately taken a decided turn for the better, for previous handicaps—small size, severely limited weight-lifting capacity, and the gruelling strain imposed by hovering and "dunking" operations on the relatively low-powered engines—have been largely overcome.

Initially the anti-submarine helicopter will be employed—by the U.S. Navy at least—in convoy screens and for general anti-submarine surveillance, but new weapons will soon make it possible for such machines to effect the kill also. The U.S. Navy, moreover, has tried out helicopters as minesweepers—by dragging hooked cables through the water to engage with the moorings of the mines.

Although it has been officially stated in Great Britain that "about a hundred" military-type Bristol 173s are on order, it is not known how many of these are for anti-submarine work.

New weapons include homing torpedoes, and possibly guided missiles of the Fairchild Petrel type. According to the American

Fairey Gannet A.S.1 (Armstrong Siddeley Double Mamba).

Sikorsky XHSS-1 demonstrating "sonar" submarine detecting gear.

Military Aircraft 1954

Ship-borne Anti-submarine

journal *Aviation Week*, the year 1954 will see the introduction into U.S. Naval service of a British-model sonobuoy—the T1946A—which will be used until the American Service introduces a larger, improved model. Present U.S.-made sonobuoys, it is said, are non-directional and thus impractical in the present state of anti-submarine warfare.

GREAT BRITAIN

Fairey Gannet A.S.1. This eminently useful machine is now coming into service with the Royal Navy, and some account of its background is appropriate—especially in view of misconceptions which may still be prevalent. In its first form the machine was built to Specification G.R. 17/45 and a contract for a prototype was placed in August 1946. The first—two seater—prototype flew in September 1949, though the company emphasizes that this machine only "vaguely resembled the present Gannet A.S.1". Developments in armament, radar and operational techniques caused the Naval Staff to modify their thinking and to ask for a three-seater with numerous alterations; these changes were "simulated" in the third prototype, which flew in May 1951. The three G.R. 17/45 prototypes made between them over 250 deck landings, enabling the first production Gannet to make a trouble-free series of deck landings—many of them in poor weather and at night—in October 1953.

The Gannet is frequently compared—and rightly so—with the Grumman S2F-1, later described, though the Fairey machine has an Armstrong Siddeley Double Mamba turboprop and the Grumman two Wright Cyclone piston engines. In this connection it can be said that, while the Fairey and Armstrong Siddeley companies were cognisant of the merits of piston engines for anti-submarine work, it was decided to go ahead with the new type of power plant in view of the Admiralty policy to avoid having to store petrol aboard aircraft carriers. It was the Fairey company who, aware that the specific fuel consumption of a turboprop increased with throttling, suggested the use of twin turbines, one of which could be shut down to idling while the second was running somewhere near maximum power for cruising. Other advantages foreseen—and realized—were the increased safety factor in long-distance over-water operation, especially in bad weather at night, and the extended engine life.

Although journalists have not yet been authorized to fly in Gannets, it is understood that the Double Mamba runs smoothly and that the noise level inside the cockpits is very low.

With the earlier, Griffon-engined Firefly the Fairey company became acutely aware of the difficulty of flame damping without reducing the field of view and prejudicing power output and aerodynamic efficiency. With the Double Mamba no flame is visible from the rear of the Gannet at night. For tropical use water/methanol injection has been developed as a standard fitting.

Design features of the Gannet are admirably shown in the photograph on page 855, but it may be remarked that the ventral radar housing—seen, below the recognition roundel, in the raised position—is mechanically lowered when required. "Attack weapons" are stowed internally and provision is made for sonobuoys and other equipment beneath the wings.

Short Seamew A.S.1. This light, cheap machine was specifically designed for operation from escort carriers and is powered by a single Armstrong Siddeley Mamba turboprop. It carries a crew of two and can be used for search and strike. The makers maintain that, apart from the aspect of cost (unit cost of the Seamew is said to be between £50,000 and £60,000), there is a highly important tactical reason for keeping down the weight of Naval aircraft, which is bound up with the fact that these must be able to operate in all types of weather—or at least the weather in which a submarine can operate. It is their contention also, that a large number of small reconnaissance and strike aircraft would be far more effective and efficient than a smaller number of larger and more expensive machines.

Seamew features visible in the photograph are the very high placed cockpits (the pilot's range of view is exceptionally wide) and the fixed undercarriage. Provision is made for full de-icing and for the attachment of stores beneath the wings.

Span, 55ft; length, 41ft.

U.S.A.

Bell HSL-1. This is the first rotary-wing aircraft ever designed specifically for anti-submarine warfare and was built to a 1950 specification. It is being supplied not only to the U.S. Navy but to our own Royal Navy.

The relatively small fuselage is accounted for by the necessity of stowing the machine aboard aircraft carriers, and the same consideration dictated that the rotor blades should fold. The engines are Pratt and Whitney R-2800-50s, which easily lift the 4,000 lb or so of anti-submarine stores, including search radar and "dunking" sonobuoys and fuel for a lengthy endurance.

To reduce crew fatigue during long searches in all weathers, the manufacturers designed their own automatic pilot, the unique feature of which is that the helicopter control system, and not the fuselage, is stabilized. This permits rapid variations in c.g. position (as might follow the dropping of weapons) without affecting the flight path and without the need for retrimming. Pilot control of the pitch and roll channels is accomplished by simple manual movement of the cyclic-pitch stick.

Directional heading is controlled by a G-2 gyro compass integrated with the autopilot, and changes in heading can be made in two ways. In hovering flight, the HSL can be yawed by the application of pedal pressure, the pedal force governing the rate of yaw. In forward flight, an automatically co-ordinated turn can be made by depressing a button on the cyclic stick and establishing the desired angle of bank with stick movement. Once on the new heading, the pilot recovers from the turn, and re-engagement of the button ensures that the new course will be

Grumman AF-2S Guardian (Pratt and Whitney R-2800-48W).

Douglas AD-4W Skyraider (Wright R-3350-26W).

Grumman S2F-1 (two Wright R-1820-76 Cyclones).

Bell HSL-1 (Pratt and Whitney R-2800 Double Wasp).

maintained. Collective pitch, and thus altitude, in forward flight is maintained by a pressure-sensing servo which varies collective pitch as a function of pressure altitude related to reference altitude. At any time the pilot can override any commands or displacements imposed by the autopilot simply by applying a moderate force to the primary controls; this is made possible by slip clutches between the servos and the system.

Douglas AD-4 and 5 Skyraider. As intimated in the section dealing with carrier-borne strike aircraft, these Skyraiders can be employed for anti-submarine work and for early warning. A feature of the search and early-warning models is the massive "guppy" search-radar unit in the form of a plastic bowl beneath the forward fuselage. For early warning two crew members are carried in the aft fuselage to handle the radar, and to accommodate them the dive brakes are deleted. Armament is removed, no auxiliary fuel tanks are installed, and a P.1 automatic pilot is fitted to relieve the pilot on long patrols. The countermeasures versions, incidentally, carry one additional operator in the aft fuselage to work the special radar gear; this includes detector equipment, to isolate and identify the frequency of enemy radar, and special transmitters to produce interference frequencies intended to jam the enemy equipment.

Grumman AF-2 Guardian. The Guardian is the standard fixed-wing anti-submarine aircraft of the U.S. Navy, but is in process of being replaced by the later S2F. There are two basic versions—the AF-2W which, equipped with "guppy" search radar, serves as a hunter, and the AF-2S, which carries weapons in place of the radar. In both sub-types a crew of three is normal—a pilot and two radar operators in the -2W, and a pilot, navigator/bomb-aimer and radar operator in the -2S. Typical internal loads of the latter are one 2,000 lb torpedo, two 1,600 lb depth charges, or two 2,000 lb bombs. Additionally the -2S can carry offensive stores under the wings and has a searchlight and radar scanner.

Span, 60ft 8in; length, 43ft 4in; max. speed, about 300 m.p.h.

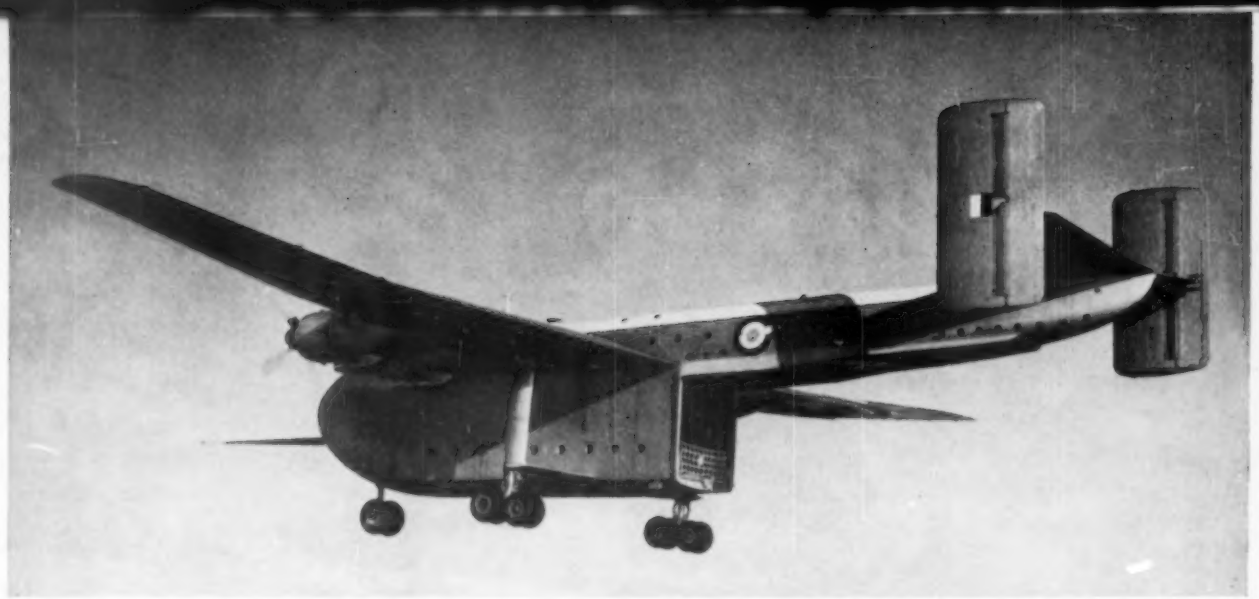
Grumman S2F-1. Whereas the two Guardian versions work as a hunter/killer team, the S2F-1 combines the two functions. Powered with two Wright R-1820-76 Cyclones, it carries a four-man crew, the latest electronic equipment and homing torpedoes, depth charges, bombs and/or rockets. Sonobuoys are believed to be stowed in the tails of the engine nacelles, and the search radar is in a retractable housing aft of the bomb bay, as on the Fairey Gannet. The S2F-1 is equipped for all-weather operation, and to this end the latest navigational equipment is specified. A special combustion heater serves the cabin, the electronic equipment and the torpedo compartments.

S2F-1s will be supplied not only to the U.S. Navy but to the Royal Canadian Navy, who consider that of fourteen operational rôles which come within the scope of naval aviation, the type can perform twelve.

Sikorsky HO4S-1, 2 and 3. These are anti-submarine versions of the basic Sikorsky S-55. The -1 and -2 are powered with a Pratt and Whitney R-1340 Wasp, but the -3 has the more powerful Wright R-1300 Cyclone. It is generally agreed in the U.S. Navy that these machines cannot do more than a marginal job in the anti-submarine rôle, and this realization has led to the development of the HSS-1.

Sikorsky HSS-1. This machine is considerably larger than the HO4S models and bears the Sikorsky type number S-58. Design features of both the S-51 and S-56 are embodied, and the 1,525 h.p. Wright R-1820 Cyclone is mounted at an angle of 34 deg in the nose. The rear fuselage has a large fin and is hinged to fold for carrier stowage. The main rotor has four blades and these can also be folded by hand.

Military prototype of Bristol 173 (two Alvis Leonides). An anti-submarine version is being developed for the Royal Navy.



Blackburn Beverley C.1 (four Bristol Centaurus).

Military Aircraft 1954

TRANSPORTS

Under this heading will be reviewed—or previewed—some developments and projects of weighty significance, not to military transport alone but also to commercial operations—machines such as the Blackburn Beverley, Vickers 1000, Lockheed C-130, Boeing 707 and Douglas C-132; and here, too, the big flying-boat holds a place, if somewhat precariously. It will be shown that the large troop-carrying assault helicopter is already making a strong bid against such eminently practical fixed-wing machines as the Fairchild-built Chase C-123; and the big convertiplane is, perhaps, not many years distant.

That semi-specialized ambulance machines—exemplified by the Convair Samaritan—should be establishing a place for themselves is hardly surprising when it is remembered that during the Korean campaign more than 95 per cent of combat casualties were air-lifted back to the U.S.A., and that the mortality rate of American wounded was less than one-half that of World War II. The tactical use of "cas. evac." helicopters in Korea is already history.

GREAT BRITAIN

Blackburn Beverley C.1. The Beverley C.1 is the R.A.F. production version of the Universal Freighter, G.A.L.60 Mk 2, and is powered with four Bristol Centaurus engines of unspecified mark. It is similar in all essentials to the civil machine, which would weigh about 61 tons, and have a main cargo hold measuring 40ft × 10ft × 10ft. Ten jeeps can be carried in the main freight compartment, in addition to troops in the rear fuselage, and it may be noted that the Beverley is the first British aircraft designed for the dropping of heavy army equipment, for which purpose the rear-loading doors are removed. The undercarriage is fixed and is designed to allow the Beverley to operate without the use of prepared runways. Though no actual performance figures can be quoted, it is known that the prototype has been flown on two engines—even at maximum all-up weight—without loss of height, and it has climbed above the estimated service ceiling. By the use of wheel brakes, and in a light wind, the aircraft has been using less than half the maker's 1,400-yd runway for landing, and this distance can be considerably reduced by the use of braking airscrews.

Design studies have been made of Beverley developments with Napier Nomad compounded engines, Wright Turbo-Compounds, and possibly with a new type of Rolls-Royce turboprop.

Span, 162ft; length 99ft 2in.

Bristol Type 170. Military versions of the Type 170 are used by the air forces of Australia, Canada, New Zealand and Pakistan. Dependable and economical, these machines have the advantage of nose-opening doors, but lack rear doors for loading and heavy dropping. Span, 108ft; length, 68ft 4in.

Handley Page Hastings C.2. This is the standard heavy trooper/freighter of R.A.F. Transport Command. Powered with Bristol Hercules 106 engines, it accommodates 30 paratroops with supplies, 50 fully equipped troops, 32 stretcher cases and 28 sitting-wounded, or any of several combinations of freight loads.

Span, 113ft; length, 81ft 8in; basic equipped weight (freighter), 48,427 lb; max. take-off weight, 80,000 lb; max. weak-mixture cruising speed, 291 m.p.h. at 15,200ft, or 302 m.p.h. at 23,600ft; range for max. payload, 1,690 miles.

Saunders-Roe Princess. This great Proteus-powered flying-boat—designed to fly at a gross weight of 330,000 lb and to cruise at speeds up to 380 m.p.h.—was not originally intended for military use, though the possibilities of this have been very carefully studied. With its capacity for 200 troops, and with its range of 3,500 miles, the Princess could carry in one year as many

Handley Page Hastings C.2 (four Bristol Hercules 106).

Vickers 1000 (four Rolls-Royce Conway).

Boeing 707 Stratotanker (four Pratt and Whitney J57), with a Boeing KC-97G Stratofreighter (four Pratt and Whitney R-4360) beyond.

troops as three ordinary troopships on strategic routes.

Vickers-Armstrongs Valetta C.1. The R.A.F.'s standard twin-engined multi-purpose transport for troops, freight, paratroops, supplies and casualties, the Valetta has a cabin of 1,565 cu ft volume. The engines are Bristol Hercules 230s, span 89ft 5in, length 63ft 2in, gross weight, 36,500 lb, and economical cruising speed, 172 m.p.h.

Vickers-Armstrongs 1000. Early in 1953 Vickers-Armstrongs, Ltd., disclosed that they had been authorized to start work on a new jet-propelled military transport designated Vickers 1000. The essential characteristics of this remarkable aircraft are seen in the photograph of the model. All that can be added is that the power plant is four Rolls-Royce Conway by-pass units, in which very high thrust is reconciled with unusually low specific fuel consumption. Although the Vickers 1000 follows the general pattern of the Valiant bomber, it is, in fact, a very much larger aircraft. A civil project of similar type, designated V.C.7, is designed to be capable of operating on very long trans-oceanic routes or over relatively short distances—in the latter case with up to 150 passengers. Cruising Mach number should be in excess of 0.9. It has been reported in America that the international version of this machine would operate at a weight of 222,000 lb and that a "domestic" model would weigh 180,000 lb.

CANADA

Canadair North Star. Under the designation North Star or C-54GM, twenty-four military versions of the Canadair Four have been supplied to the Royal Canadian Air Force. Rolls-Royce Merlin 620 engines are fitted. Aircraft of this type maintained for four years the Dorval-Tokyo air-lift.

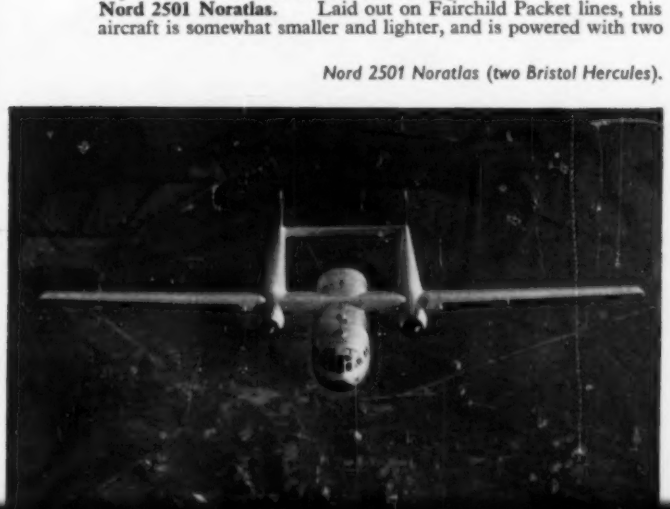
Canadair Five. An enlarged development of the Canadair Four, powered with four Pratt and Whitney R-2800 engines.

FRANCE

Hurel-Dubois H.D. 32. Although this remarkable ultra-high-aspect ratio (147ft 7in span) twin-engined transport has been known to date only in civil guise, it is also being offered as a military assault transport. It has a permissible take-off weight of 39,680 lb, and a cruising speed approaching 170 m.p.h. at 9,870ft. The fuselage is 77ft 2in long, and at its widest point measures 8ft 8in across. The cargo floor is 43ft 2in long and will support a load of 123 lb/sq ft. Neither rear nor front loading is provided, but the loading door on the port side is large enough to admit any article which will fit into the fuselage.

Nord 2501 Noratlas. Laid out on Fairchild Packet lines, this aircraft is somewhat smaller and lighter, and is powered with two Bristol Hercules engines. The main stowage space is 32ft 5in long, 9ft high, and 7ft 10in wide, giving a volume of 1,800 cu ft. At the rear, the fuselage is split vertically and the two halves can be swung open for loading or discharging. For heavy dropping operations the rear doors can be removed. Span, 106ft 7in, length 72ft, weight empty 26,030 lb, gross weight, 43,120 lb, max. cruising speed 208 m.p.h., take-off run 720 yd.

Nord 2501 Noratlas (two Bristol Hercules).



RUSSIA

I1-12. A number of slightly differing versions of the basic I1-12 design are in service with the Soviet Air Force. They are equipped for troop-carrying, freighting, and glider-towing, and some are fitted to allow small arms to be used defensively. Power plant is two ASh-82FNV engines, and cruising speeds of about 200 m.p.h. are possible. Span, 104ft.

U.S.A.

Boeing 707 Stratotanker. The fullest appreciation of this very important transport aircraft yet published was that in *Flight* of May 28th this year. It was then remarked that, although Boeing had followed conventional stressed-skin practice, this was carried to an extremely high pitch of development. The 128ft fuselage is almost entirely pressurized and the wing passes through it just beneath the main floor. The structure itself is very similar to that of the C-97, with closely spaced hoop frames leaving the interior quite unobstructed. Large cargo doors are fitted on the upper deck; these hinge outwards and upwards, and as each has an area of at least 75 sq ft the doors are a remarkable engineering achievement, for the pressure differential is of the order of 9 lb/sq in, which means that the in-flight load on each door must be about 44 tons.

The four Pratt and Whitney J57 two-spool turbojets are mounted in single pods under the swept wing, the bottom of each inner pod being no more than 28in from the ground. The wing has a useful thickness, especially at the root, and a great quantity of fuel is stowed between the spars as follows: outboard of the outer engines, 392 gal in each wing; between the pods, 1,808 gal; between the inner pod and the fuselage, 1,958 gal plus 1,540 gal. With the 3,500 gal overload tank in the centre section, the total tankage is 14,896 gal, which would weigh some 116,000 lb. It is likely that tank purging will be provided, as on the Boeing bombers.

Although the present Stratotanker is known to be the prototype of a military transport/tanker, there is as yet no indication of flight-refuelling equipment. As for carrying capacity, it is known that the civil version would carry from 80-130 passengers at 30,000-40,000ft, and that the direct cost per mile would be about double that of the DC-6. Provisional calculations, however, show that the jet-propelled Boeing could do three times as much work in a given time as the piston-engined Douglas.

Points of interest are that the entire flying control system is manually operated and that the bogie main undercarriage folds sideways into the thickened wing root and fuselage sections. There is a large pressurized equipment and freight hold in the lower portion of the forward fuselage, and another large freight compartment behind the bogie stowage.

Boeing KC-97G Stratofreighter. This is the latest version of the C-97 and KC-97 Stratofreighter series, and differs from the preceding KC-97F in having revised refuelling tankage and equipment which can be retained in place even when the aircraft is used as a transport. Twenty of these aircraft are being attached

Military Aircraft 1954

Transports

to each 45-strong wing of B-47 Stratojet bombers. Similar machines also serve as cargo and personnel transports with the Strategic Air Command of the U.S.A.F., and with the Military Air Transport Service. The crew and passenger/cargo compartments are pressurized to allow the KC-97G to cruise at 25,000ft, with a cabin pressure equivalent of only 5,500ft, and it is known that the C-97s of M.A.T.S. make frequent use of high-altitude jet streams to make the Tokyo-Honolulu trip non-stop. The gross weight of 175,000 lb is 55,000 lb more than that of the original XC-97. Span, 141ft 3in; length, 110ft 4in; cruising speed, about 300 m.p.h.; max. range, 3,750 miles approx.

Two KC-97Gs are being converted to turboprop power.

Chase C-123B. This distinctive, twin-engined, high-wing monoplane transport is now in production—to the extent of 150 machines—at the Fairchild plant. Powered with two Pratt and Whitney R-2800-99W radials, its empty and gross weights are about 30,000 lb and 71,000 lb respectively. A cruising speed of about 200 m.p.h. is attainable, and the stalling speed is 75 m.p.h. The cargo compartment is 36ft 8in long, 9ft 2in wide, and 8ft 2in high, notable for its unobstructed space. At the rear is a hydraulically operated ramp, capable of taking such heavy loads as a 155 mm howitzer and a truck. Provision can be made for over 60 fully equipped troops, 50 stretcher patients and six sitting patients, with six attendants. The side doors are used not only as normal entries and exits, but for parachute drops. It is understood that a C-123B is being adapted for experiments with boundary-layer control. Span of the standard aircraft is 110ft, length, 75ft 9in.

Convair C-131A and C Samaritan. The Samaritan is a military ambulance version of the Convair 240. The twenty-six being delivered to M.A.T.S. have provision for various loads, i.e., 37 seats or 27 stretchers and seven seats. Principal mission of the Samaritan is the delivery of patients from ports of entry to hospitals of destination in the U.S.A., and it is the first pressurized twin-engined air evacuation transport. Pratt and Whitney R-2800-99 engines are specified, and the gross weight is 43,575 lb. Provision is made for iron lungs and special oxygen equipment. The C-131A should not be confused with the C-131C—an aircraft for similar duties based on the Convair 340. Under the designation YC-135, two military 340s are being powered with Allison T56 turboprops. Span (C-131A), 91ft 9in; length, 74ft 8in.

Convair R3Y-1 and R3Y-2 Tradewind. The R3Y-1 is a version of the XP5Y-1, originally developed for long-range maritime reconnaissance. Intended for the logistic support of fleet units, it weighs about 80 tons and has a speed in excess of 350 m.p.h. The power plant is four Allison T40 turboprops, the cabin is fully pressurized, the seats face aft, and three flight-refuelling hoses—at the stern and wing-tips—can be built in. The R3Y-2 (just completed) has nose doors, through which vehicles, or an assault company of soldiers, can be directly disembarked on to an enemy beach. For this version a top speed of more than 400 m.p.h. has been announced. Typical loads are six jeeps or four 155 mm howitzers. Span, 145ft; length 142ft 6in.

(Above) Convair R3Y-1 Tradewind (four Allison T40-A-10). (Below) Douglas C-124A Globemaster II (four Pratt and Whitney R-4360).

Douglas C-124A and C Globemaster II. These two versions of the Globemaster II are generally similar, but are powered respectively with Pratt and Whitney R-4360-20W and R-4360-63 engines. They fly at a gross weight of 175,000 lb and are capable of carrying a load of up to 50,000 lb for a range of 1,000 miles, with fuel remaining for return to base. Typical loads would be troops, tanks, field guns, bulldozers or cranes. In this latter connection it is said that the Globemaster II can handle 94 per cent of all U.S. military vehicles, and that at present only a C-124 fleet can transport by air an entire infantry division, including all the millions of pounds of equipment required for its support.

Since going into operation the C-124A has notably exceeded its designed carrying capacity by taking off at an a.u.w. of 194,000 lb, at which weight a 50,000 lb payload can be carried for a range in excess of 2,500 statute miles, with reserves. For shorter ranges the maximum payload can be increased to more than 70,000 lb. Cubic capacity for stowage totals about 10,000 cu ft and the hold is quickly convertible into a double-deck layout for 200 troops, with equipment. In the ambulance rôle 127 stretchers and their attendants can be accommodated. A built-in nose ramp and an electrically operated lift amidships speed loading and discharge. Span, 173ft 3in; length, 127ft 2in.

Douglas YC-124B Globemaster. Basically a C-124A, this experimental development is powered with Pratt and Whitney T34-P-1 turboprops, each developing 5,700 e.s.h.p. Unlike the C-124A and C, this new version is pressurized, to give 8,000ft interior at 30,000ft. The vertical tail is taller and the horizontal tail has a new profile for greater stability and improved control. The whole structure has been revised and strengthened. With about 60 per cent more power than its predecessors, the YC-124B can lift 64,000 lb design payload for a gross weight of 200,000 lb.

Douglas C-118A and R6D-1. These are military versions—for the U.S.A.F. and U.S. Navy respectively—of the civil DC-6A, and have special provision for quick conversion to personnel or troop transports, carrying 75 men, or to ambulance machines, with accommodation for 60 stretchers. Stowage capacity for payload—up to 29,500 lb—totals 5,000 cu ft. The engines are Pratt and Whitney R-2800s, maximum speed 371 m.p.h., cruising speed 315 m.p.h., and maximum range 4,980 miles. Gross weight is 107,000 lb and span 117ft 6in.

Douglas XC-132. A very large, turboprop-powered transport for the U.S.A.F., capable of carrying 100,000 lb payload.

Douglas C-133. An improved—and somewhat larger—version of the YC-124B.

Fairchild C-119F Packet. A common production version of the C-119 Packet, the "F" variant has two Wright R-3350-85 engines, and the G is similar but has Aeroproducts airscrews instead of Hamilton Standard. The R4Q-2 is the U.S. Marine Corps version, and the C-119H is an extensively redesigned development—with new wings of greater span—which has not been ordered into production.

The stowage hold of the Packet is 36ft 11in long, 9ft 10in wide, and 8ft high, giving a volume of 3,150 cu ft. On exercises last year U.S. Army and Air Force crews parachuted from machines of this type a 21,000 lb tractor, with bulldozer; a 21,000 lb front-loader tractor; an 18,000 lb rubber-wheeler tractor; an 18,000 lb grader; a 17,500 lb dump truck; and a 13,000 lb scraper.

Lockheed R7V-1 (four Wright R-3350-34W Turbo-Compound).

Convair C-131A Samaritan (two Pratt and Whitney R-2800-99).

The C-119F has a maximum cruising speed of about 200 m.p.h. and a maximum range, with standard fuel, of 2,300 miles. The span is 109ft 3in, length 86ft 6in.

Lockheed C-121 and R7V-1 and 2. These are the latest developments in a line of Lockheed Constellation and Super Constellation variants for the U.S. Armed Services. These may briefly be defined as: C-121A, U.S.A.F. cargo version of Constellation 749; VC-121B V.V.I.P. transport version of the Model 749; C-121C, U.S.A.F. version of Super Constellation 1049B. The U.S. Navy's R7V-1 is one of the fastest military transports and can carry 106 passengers, 73 stretcher patients, or about 19 tons of cargo. It cruises at about 335 m.p.h. on the power of four Wright R-3350-34W Turbo-Compound engines, and flies at a gross weight of 133,000 lb.

The R7V-2 is a forthcoming turboprop development with Pratt and Whitney T34s; it will have two 600 U.S. gallon wing-tip tanks, and also provision for under-wing tanks, to give a total fuel capacity 8,750 U.S. gallons. The R7V-1 measures 123ft in span and is 113.7ft long.

Lockheed C-130A. This unorthodox but very promising military transport is said by its designer to have been conceived as follows: the U.S. Army needed a machine to carry soldiers, paratroops, patients and all types of ground-force equipment, including items weighing as much as 20 tons; the U.S.A.F. wanted an aircraft that would meet its tactical requirements; and at the same time the Military Air Transport Service wanted a long-range machine suited primarily for passenger work. From these various requirements the U.S.A.F. compiled specifications calling for a machine to fly at low altitude and low speed for parachute drops, or at high altitude and high speed for long-range flights. It had to be adaptable for short assault missions or for transatlantic and trans-Pacific crossings. A governing feature in the design was that the floor had to be at exact truck-bed height—45in from the ground. Another was that the turboprop power plant would be so small—and the wing so high—that the undercarriage could not conveniently be retracted into the nacelles. Accordingly, it was decided to place two huge wheels, one behind the other, on each side of the fuselage, and to fair them as seen in the picture.

The power plant is four Allison T56-A-1s, and the massive fuselage, with rear-loading doors, is fully pressurized. In the ambulance rôle the nurses will have access to the stretchers from either side, and a comfortable temperature inside the aircraft will be assured by a new heating system which will warm the cabin by heating the floor. All tie-down fittings will take a 10,000 lb load, and there will be other fittings stressed to take 25,000 lb loads. Span, 132ft; length, 95ft; gross weight, 130,000 lb; max. speed, 400 m.p.h. approx.

Piasecki YH-16 Transporter. This is the world's largest helicopter, measuring 134ft overall and standing 25ft high. It was built to U.S.A.F. requirements for a long-range rescue and transport helicopter and to Army requirements for a troop and cargo transport. The fuselage is nearly 78ft long—about the size of a Convair 240's—and holds 40 troops, 32 stretcher patients or three jeeps. Two Pratt and Whitney R-2180 engines are installed, and it is thought that the speed will be higher than that of the

Chase XC-123 (two Pratt and Whitney R-2800-99W).

Douglas R6D-1 (four Pratt and Whitney R-2800).

H-21, which last year set up a world speed record of 146.7 m.p.h. There is provision beneath the fuselage for a cargo "pack," and when this is fitted a special tall undercarriage, which raises the fuselage proper about 10ft off the ground, is necessary. At the forward end of the cabin is a normal door and at the rear a ramp, which can be lowered for the fast loading and discharging of

Fairchild C-119 Packet dropping paratroops.

Sikorsky XHR2S-1 (two Pratt and Whitney R-2800-50).

Model of Lockheed C-130 (four Allison T56-A-1).

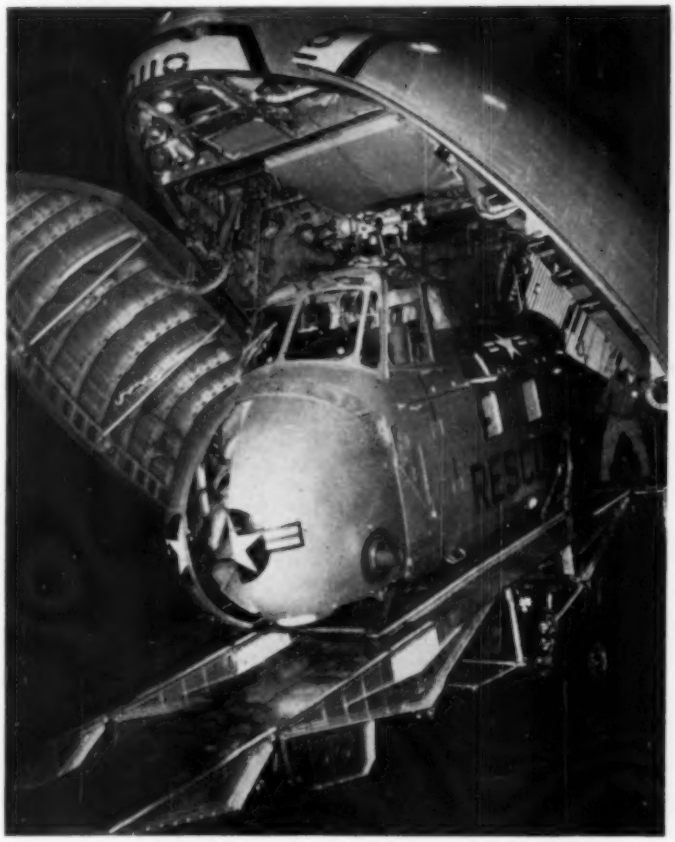
Military Aircraft 1954 | Transports

vehicles, guns, cargo, personnel or patients. Outside the forward cabin door is a cable hoist operated by the pilot. It is said to be possible in the YH-16 to place the load anywhere in the cabin, for the machine has a larger centre of gravity travel than any other aircraft, including the great Convair B-36 bomber.

Piasecki YH-16A. This is a developed version of the YH-16, with two Allison turboprops of the T38 class.

Sikorsky HR2S-1. The basic design of this machine was drawn up to meet the requirements of the U.S. Marine Corps for an assault transport. The prototype XHR2S-1 flew last December, and since that date a number of other examples have been tested. There are two Pratt and Whitney R-2800-50 engines, mounted in large nacelles carried well clear of the fuselage on stub wings and toed inwards so that a straight-through drive is obtained to the main central gear-box. A small hole in the nose of each nacelle admits air to the injection carburettors, and the main cooling intakes are in the leading edges of the stub wing. The rotor has five identical blades and the disc loading is very high. The retractable undercarriage has large single main wheels with brakes, and a single castering, lockable tailwheel, an arrangement which was not possible with the old tail-boom layout—superseded in the HR2S by a more conventional fuselage. Small hydraulic motors are said to drive the individual wheels for easier deck handling. All fuel is carried in the stub wings, leaving the fuselage free of obstructions and equipment. The normal load is to be two sections of U.S.M.C. assault troops (a total of 26), with equipment, or three small "Mighty Mite" Navy jeeps, or combinations of other vehicles to a similar total bulk and weight. Provision—including extensive de-icing—is made for all-weather flying.

The Sikorsky company believes that proper aerofoil tail surfaces and an aeroplane-type fuselage pay big dividends in stability. Small as they are, the stub wings still give considerable lift in cruising flight, and the large tailplane, with big trimming surfaces, is necessitated by the disturbed air flow which extends to the rear of, and below, the main rotor, even in fast forward flight. The aircraft is trimmed by normal "elevator trimmer" controls; additionally there are large moving surfaces in the trailing edge of each stub wing.



Loading a Sikorsky H-19 helicopter aboard a Douglas C-124 Globemaster.

Piasecki YH-16 (two Pratt and Whitney R-2180). On the left, the smaller twin-rotor machine is an H-21 Workhorse, and in the foreground an HUP-2.

DUNLOP

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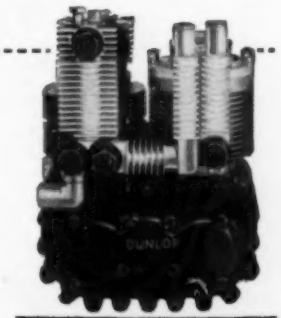

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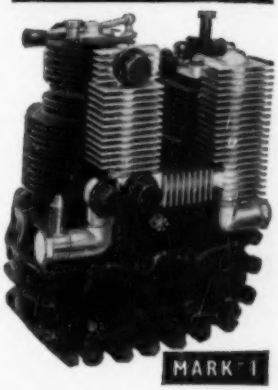
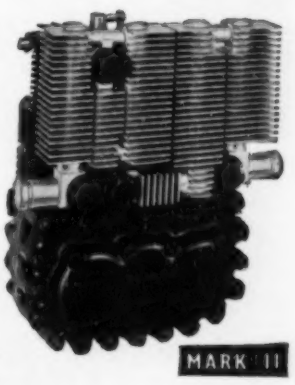


MARK I

A three-stage compressor weighing only 9½ lbs. and designed to take full advantage of jet engine supercharging.

MARK II

Developed to meet the heavier needs of multi-jet aircraft. It is particularly suitable for gas turbine starters and has an increased performance at higher altitudes.



	Working Pressure p.s.i.	r.p.m. (cruising)	Nominal Delivery cu-ft/min Free Air	Boost Pressure p.s.i.
Mk. I	3300	3200	2½	30
Mk. II	3300	3200	4	20

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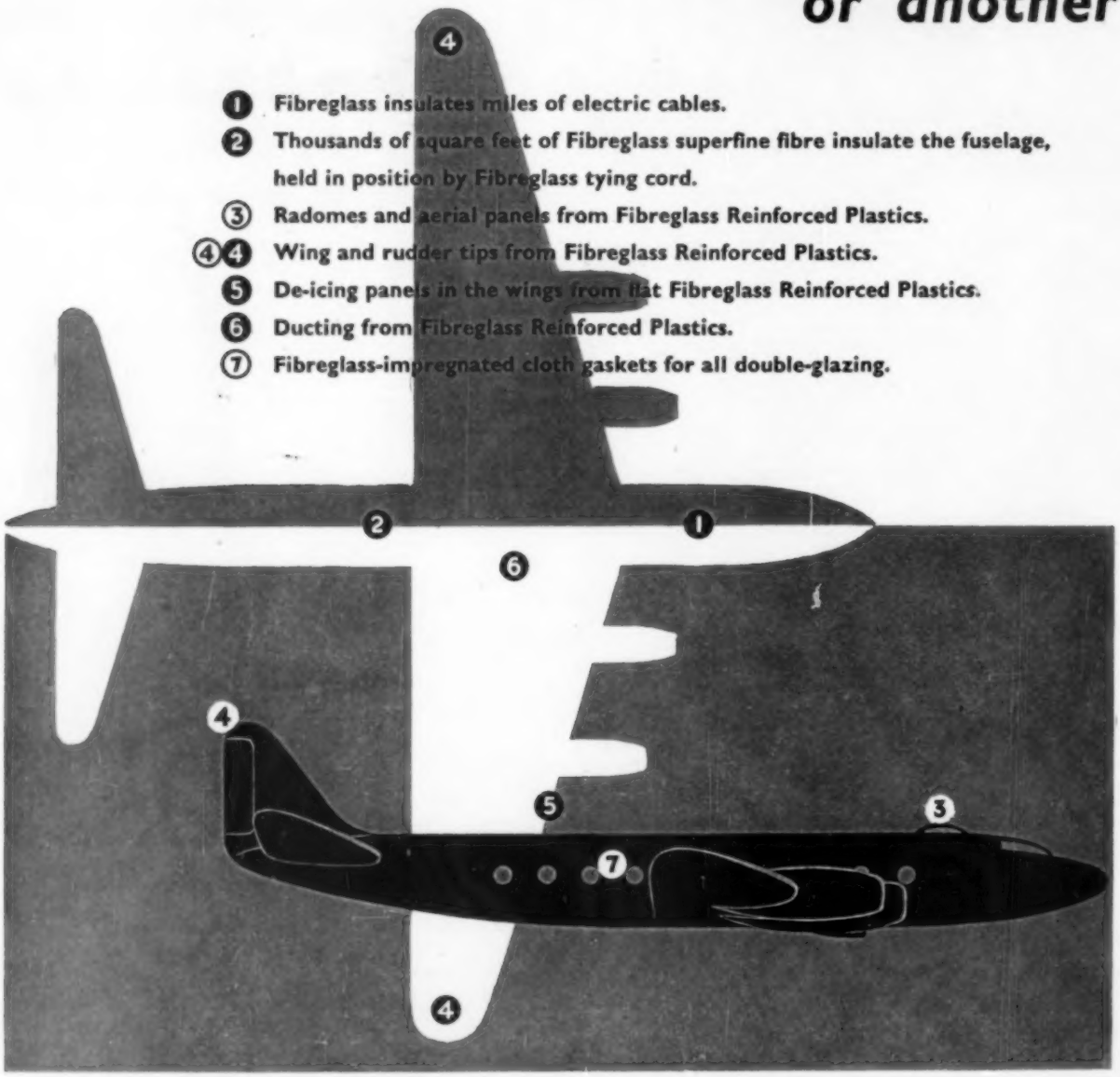

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Auster A.O.P.9 (Blackburn Cirrus Bombardier).

Military Aircraft 1954

SPOTTING AND OBSERVATION

Although certain aircraft dealt with under this heading are officially classed as "liaison" machines, we have included under our own *Liaison* heading, on the following page, only such types as are not normally employed on artillery spotting and observation, reserving for the present section those which would be known in Great Britain as air observation posts. By their very nature these are highly versatile, and the following assignments are typical: spotting, observation, reconnaissance, rescue, patrol, photography, supply of ground forces, wire-laying, liaison, message pick-up and dropping, casualty evacuation, and the direction of attack aircraft to enemy strongpoints.

GREAT BRITAIN

Auster A.O.P.9. Latest addition to the Auster A.O.P. range, this machine is powered by a Blackburn Cirrus Bombardier and has a fuselage 46in wide, an unusually strong undercarriage and very effective flaps and drooping ailerons. There are three seats and stowage for full military radio. Span, 36ft 5in; length, 23ft 8¼in; weight empty, 1,461 lb; gross weight, 2,050 lb; take-off distance to 50ft, less than 260 yd; rate of climb at sea level, 930 ft/min; operational range, 214 nautical miles.

DENMARK

KZ-A.O.P. Powered with a Continental C-145-2 engine, with Aeromatic automatically variable-pitch airscrew, this two-seater weighs 1,900 lb all-up, takes off from grass in about 400ft, and lands in about 160ft.

FRANCE

Nord N.C.856A. A development of a civil type, the N.C.856A is now in production for the French Army. A two-seater, it has a Regnier 4L-O4 engine, and weighs just under 2,000 lb all-up. In the A.O.P. rôle endurance is 1 hr, but this can be extended to three hours for liaison. Span, 41ft; length, 25ft 4in.

U.S.A.

American Helicopter XH-26. Known as the Jet Jeep, this experimental single-seater is powered with pulsejets and weighs only 300 lb empty, though the designed gross weight is 900 lb. It can be collapsed into a 5ft × 5ft × 14ft container and be dropped by parachute. Having been unpacked, it can be in the air within 20 min on an observation or reconnaissance mission. Top speed is about 80 m.p.h. and endurance 1½ hr.

Cessna L-19A Bird Dog, XL-19B, OE-1 and OE-2. These military Cessnas are distinguished by the following characteristics: L.19A—a two-seater very largely used by the U.S. Army Field Forces, powered by a Continental 0-470-11 flat-six and weighing 1,498 lb empty and 2,430 lb all-up, stalling speed, 54 m.p.h., initial rate of climb, 1,490 ft/min. XL-19B—an experimental development of the basic L-19 with a 210 h.p. Boeing 502-H turboprop, holder of the world's light-aircraft altitude record of 37,063ft. OE-1—U.S. Marine Corps version of the L-19A. OE-2—for the U.S. Navy, having redesigned tail, revised cowling, and the more powerful Continental SO-470 supercharged engine of 260 h.p., driving a constant-speed airscrew.

(Top left) Cessna L-19A (Continental O-470-11). (Top right) American Helicopter XH-26. (Bottom left) KZ-A.O.P. (Continental C-145-2). (Bottom right) Nord N.C.856A (Regnier 4L-O4).

Military Aircraft 1954

LIAISON

GREAT BRITAIN

Percival Sea Prince. Two versions of the Sea Prince—the C.1 and C.2—are serving with the Royal Navy. They are similar, but the latter flies at a higher all-up weight and has a revised undercarriage, with dual main wheels.

Percival Pembroke. A development of the Prince, adopted by the R.A.F., the Southern Rhodesian, Royal Swedish and Royal Belgian Air Forces and suitable for transport of supplies and equipment, for ambulance work or supply-dropping. A feature which enabled R.A.F. requirements to be met with very little modification to the existing configuration was the exceptionally roomy cabin, seating eight passengers in rearward-facing seats. Span, 64ft 6in; length 46ft; weight, 13,000 lb; max. speed, 220 m.p.h.

Scottish Aviation Prestwick Pioneer II. Powered with an Alvis Leonides, this aircraft is used by the R.A.F. in Malaya. It can operate as a four-seater passenger transport, or as an ambulance, with pilot, patient, nurse and, if necessary, a doctor. Low-speed performance is obtained through the use of full-span slats together with Fowler-type flaps. Span, 52ft 9in; length, 34ft 7in; gross weight, 5,400 lb; take-off run to 50ft, 230 yd.

CANADA

de Havilland Canada Beaver. The Beaver was adopted in 1952 by the U.S. Army as a standard liaison aircraft under the designation L-20. It is essentially a commercial Beaver, with Wasp Junior engine, but modifications render it suitable for liaison, light transport, supply-dropping, photography, casualty evacuation, visual reconnaissance, column control, wire-laying and spraying and dusting. Two 250 lb bombs or supply containers are under-wing loads. Take-off run, zero wind, 480ft.

de Havilland Canada Otter. The Otter is in service with the R.C.A.F. as a general-purpose aircraft. Its duties include search, rescue, liaison, transport and supply-dropping. As an ambulance it carries from one to six stretchers, and as a transport, fourteen soldiers. Take-off and landing distance is less than 600ft.

FRANCE

Dassault M.D.316. A development of the M.D.315, which is extensively used as a liaison machine in the French Air Force, this aircraft has two S.N.E.C.M.A. 14X or Wright R-1300 engines, and carries six passengers or freight. Span, 67ft.

U.S.A.

Beechcraft L-23A. This U.S.A.F. version of the Twin-Bonanza carries six people at 190 m.p.h. on 65 per cent of the power of the Lycoming GO-435-C2 engines. Sea-level rate of climb is 1,500 ft/min and maximum range over 1,000 miles. Take-off run to 50ft (no wind) is 450 yd.

Helio YL-24. A Lycoming-powered four-seater, the YL-24, takes off in only 220ft, in zero wind, at a weight of 2,800 lb, has a 600-mile range and a minimum speed (power on) of 30 m.p.h.

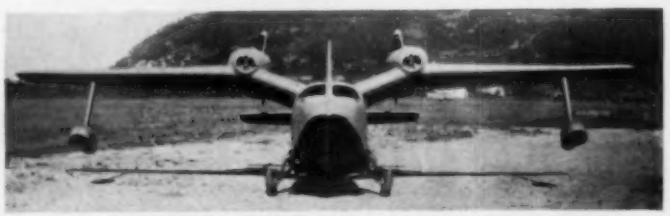
Kaman HOK-1. Designed specifically for liaison work with the U.S. Navy, the HOK-1 helicopter carries four people, and is convertible to an ambulance, in which rôle it will take two stretcher patients and one sitting patient or an orderly, in addition to the pilot. The engine is a Continental R-975-40 and gross weight about 3,500 lb.

Kaman HOK-1 (Continental R-975-40).

Helio YL-24 (Lycoming).

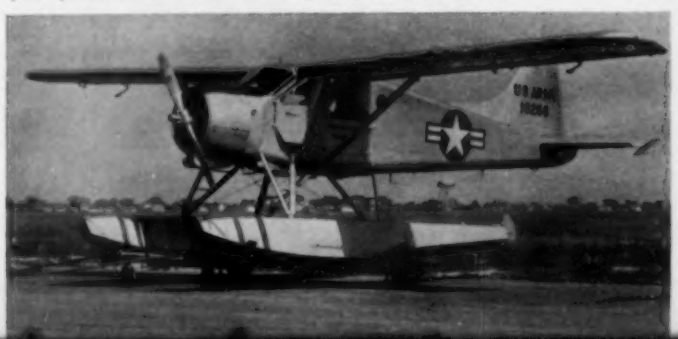
Scottish Aviation Prestwick Pioneer II (Alvis Leonides).

Percival Pembroke C.1 (two Alvis Leonides).

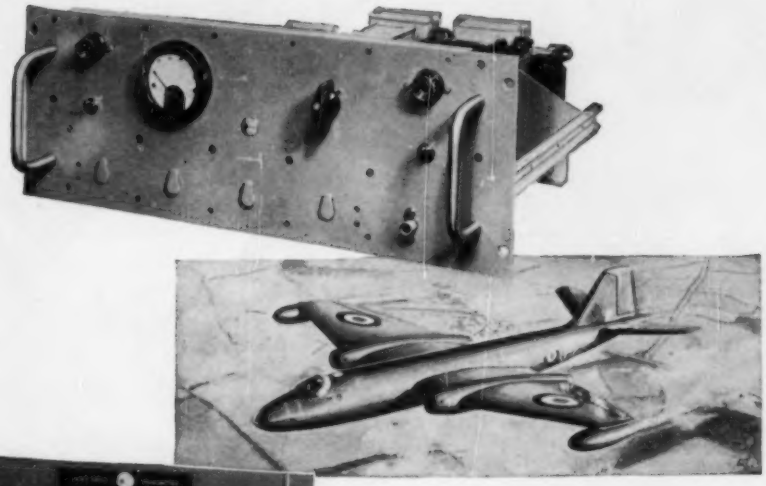


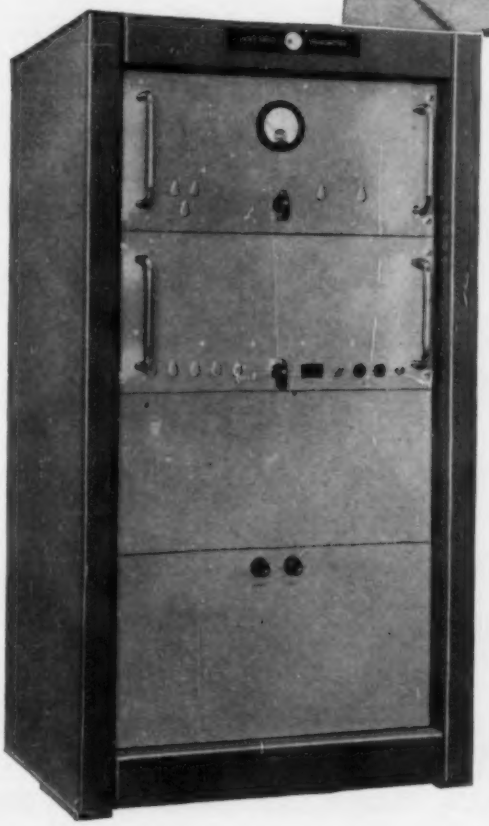
Piaggio P.136-L (two Lycoming GO-435-C2).

(Above) de Havilland Canada Otter. (Below) Beaver floatplane.



Ground to air operation by VHF airfield communication equipment





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Military Aircraft 1954

de Havilland Vampire Trainer (D.H. Goblin 3).

TRAINERS

Many of the aircraft which make up this section are still unknown quantities—if not in themselves, then in their influence on the great training programmes now being formulated. It will be noted (with considerable satisfaction on this side of the Atlantic) that, for novelty and ingenuity, as well as for sheer practicability, French and British designs are in the very forefront.

In addition to the types reviewed, trainer variants of a number of first-line aircraft, e.g., Canberra and B-47, are in service.

GREAT BRITAIN

Avro 707C. Though not strictly a trainer, this side-by-side two-seater has proved invaluable in giving pilots experience in handling deltas. The turbojet is a Rolls-Royce Derwent.

Boulton Paul Balliol T.2. Powered with a Rolls-Royce Merlin 35, this side-by-side-seater provides training by day or night in flying, gunnery, navigation, and the use of armament, and has been used for ground attack. Span, 39ft 4in; gross weight, 8,410 lb; max. speed, 288 m.p.h.

Boulton Paul Sea Balliol T.21. A deck-landing development of the Balliol T.2 for the Royal Navy.

de Havilland Vampire Trainer. The latest Vampire Trainers have, among other refinements, Martin-Baker fully automatic ejector seats, and a new cockpit canopy, affording a wider field of view. The tail has been redesigned and spin recovery is completely satisfactory. The Vampire Trainer can be armed with four 20 mm guns, bombs or rocket projectiles, and can thus be employed as a first-line attack aircraft or fighter. Span, 38ft; gross weight, 11,030 lb; max. speed, 537 m.p.h.

de Havilland Chipmunk. The all-metal tandem two-seater Chipmunk has a fixed, tailwheel, undercarriage, and carries VHF radio, full blind-flying panel and two-stage amber equipment.

Gloster Meteor T.7. An unarmed tandem two-seater, the Meteor T.7 has a sea-level rate of climb of 8,000 ft/min and a range, with normal internal fuel, of 470 miles.

Handley Page (Reading) Marathon T.11. A development of the civil Marathon, used by the R.A.F. as a flying classroom.

Percival Provost T.1. The Boscombe Down report on this eminently practical trainer reads: "An aircraft in which a pupil would gain confidence in a very short while, handling being pleasant and easy. The aircraft has no vices. All basic training, including night flying, aerobatics, and navigation and instrument flying should be carried out simply and effectively." Span, 35ft 2in; gross weight, 4,400 lb; max. speed, 200 m.p.h.

Percival Jet Provost. A development of the Provost T.1, this is the subject of a Government contract. An Armstrong Siddeley Viper 2 turbojet and a nosewheel undercarriage are fitted.

Percival Sea Prince T.1. This development of the Prince is used by the Royal Navy for instruction in navigation and anti-submarine warfare. The later, larger, Pembroke is likewise adaptable for a variety of training duties.

AUSTRALIA

Commonwealth CA-22 Winjeel. Now in production for the R.A.A.F., the Winjeel has a Pratt and Whitney Wasp Junior and, following British practice, has side-by-side seating. Span, 38ft 9in; length, 28ft 10½in; weight loaded, 4,000 lb.

Boulton Paul Balliol T.2 (Rolls-Royce Merlin 35).

Gloster Meteor T.7 (Rolls-Royce Derwent 8).

Percival Provost T.1 (Alvis Leonides 25).

(Above) Percival Jet Provost (Armstrong Siddeley Viper 2).

(Lower left) Valmet VH-2 Vihuri (Bristol Mercury VIII) and (Below) Fouga Magister (two Turboméca Marboré 2).

Fiat G 49-2 (Alvis Leonides).

Military Aircraft 1954 | Trainers

INDIA

Hindustan HT-2. Designed along Chipmunk lines, the HT-2 has a Cirrus Major 3 engine and weighs 2,240 lb all-up. Maximum speed is 130 m.p.h. and initial rate of climb 800 ft/min.

FINLAND

Valmet VH-2 Vihuri. Produced for the Finish Air Force, this advanced trainer has a Bristol Mercury VIII engine and tandem seats. Span, 33ft; max. speed, over 270 m.p.h.

FRANCE

Fouga C.M.170R Magister. A very thorough appreciation of this little machine (two Turboméca Maboré 2s) appeared in *Flight* of April 2, 1954. It has tandem seats and a "butterfly" tail. Provision is made for two 7.5 mm guns, two 110 lb bombs, and four rockets. Span, 37ft; length, 32ft 2in; empty weight, 4,268 lb; max. permissible weight, 7,055 lb, max. speed at 30,000ft, 444 m.p.h.; max. rate of climb at sea level, 3,350 ft/min.

Morane Saulnier M.S.755 Fleuret. Powered, as is the Magister, with two Turboméca Maboré 2s, this side-by-side two-seater likewise resembles a small jet fighter. Emergency escape from the pressurized cockpit is effected through a trap-door on the underside of the fuselage. Armament as for the Magister is specified. Span, 31ft 4in (33ft over tip tanks); weight empty, 4,200 lb; normal gross weight, 5,850 lb; max. speed, 447 m.p.h. at 19,680ft; initial rate of climb, 3,346 ft/min.

ITALY

Ambrosini Super S.7. A more powerful development of the S.7, this single-seater has a Gipsy Queen 70 engine, two 7.7 mm guns, and provision for bombs, rockets or an F.24 camera. Top speed is about 280 m.p.h.

Caproni F.5. Of wooden construction, the F.5 is powered with a single Turboméca Palas. It is of very small dimensions (span, 25ft 8in; wing area, 107 sq ft), but appears to seat its two occupants, tandem-wise, in reasonable comfort. Maximum speed at height is 242 m.p.h. and climb to 16,400ft, 23 min.

Fiat G 82. This trainer is developed from the G 80-1B and G 80-3B (Goblin 35) but is powered with a Rolls-Royce Nene RN2/21. Armament is two 0.5in guns, and eight rockets or two bombs. Span, 38ft 0½in; length, 42ft 5in; weight empty, 9,880 lb; all-up weight, 14,840 lb; wing loading, 50.9 lb/sq ft; max. fuel tankage, 480 gal; max. speed at 10,000ft 560 m.p.h.; min. speed at sea level, with flaps, 110 m.p.h.; range, 750 miles; climb to 30,000ft, 10 min 45 sec.

Fiat G 59. A single-seat or tandem two-seat advanced trainer with Rolls-Royce Merlin 500/20 engine, having a maximum speed of 380 m.p.h. at 21,000ft.

Fiat G 49. Alternative power plants for this tandem-seat trainer are the Alvis Leonides 502/4 Mk 24 or Pratt and Whitney R-1340-S3H1.

Fiat G 46. A D.H. Gipsy Queen 30 or Alfa Romeo 115-I*ter* powers this 3,100 lb tandem two-seater.

Macchi M.B.323. This tandem two-seater has a Pratt and Whitney R-1340 engine and fittings for guns, bombs or rockets. Span, 40ft 8in; length, 32ft 2in; gross weight, 4,950 lb; max. speed, 232 m.p.h. at 9,500ft; range, 670 miles.

Piaggio P.150. Similar in character to the Macchi M.B.323, the P.150 likewise has a Pratt and Whitney R-1340 engine and provision for armament. Span, 42ft 4in; length, 30ft 4in; gross

Morane Saulnier M.S.755 Fleuret (two Turboméca Marboré 2).

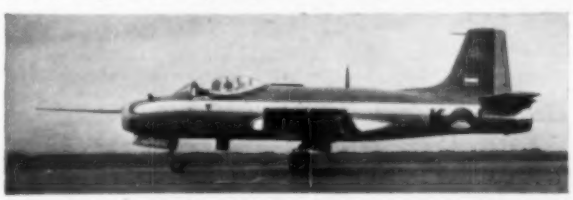
Ambrosini S.7 (D.H. Gipsy Queen).

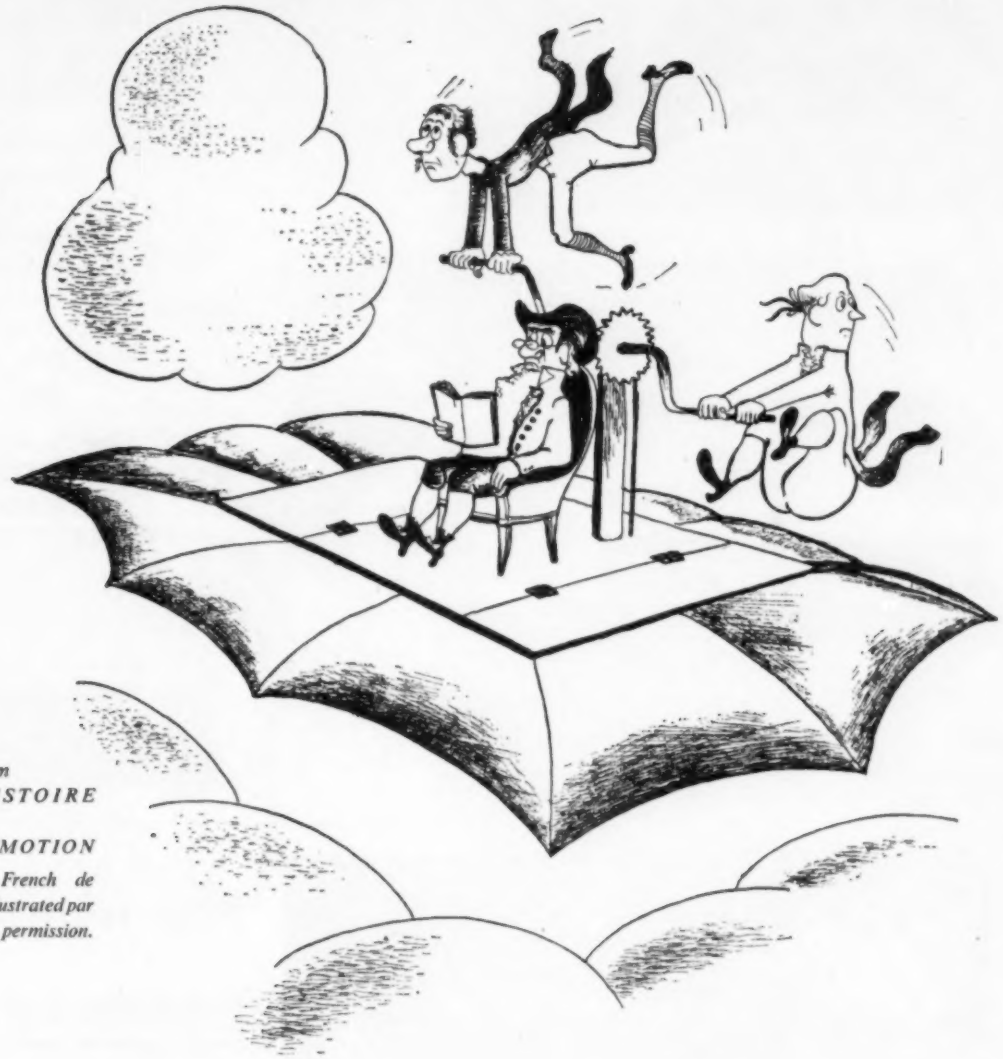
Caproni F.5 (Turboméca Palas).

Fiat G 80-1B (D.H. Goblin 35).

Piaggio P.150 (Pratt and Whitney R-1340).

(Above) Piaggio P.148. (Below) Fokker S.14 (Rolls-Royce Nene).





A page from
THE ESSO HISTOIRE OF AERIAL LOCOMOTION
Adapted from the French de P. Crochet-Damais. Illustrated par Philippe Féty avec permission.

SAMUEL MUSGRAVE AND HIS GLIDER

TO avoid the vengeance of his formidable opponent, The Knight of Eon, Doctor Samuel Musgrave decided to flee from England; and to improve his chances of a quick getaway he devised a flying machine of striking form and features. The doctor was, no doubt, inspired by the theories and aeronautical memoirs of Père Galien which were published in 1740, but his " planeur " was an original work of art and perhaps of science.

A drawing of the machine is still in existence: it shows a small hinged platform set in the middle of a large sheet of canvas, well waxed and tarred and supported by flexible whalebone struts. An auxiliary motor is mounted in the centre of the platform just behind the cockpit. The engine is a primitive jet or jet-type, producing a powerful stream of air and creating a reactive thrust capable of inducing flight.

We do not know exactly what happened to old Musgrave. He disappeared at the very moment when an engraving of the astonishing machine appeared in the papers. It is possible that he flew away—or that he didn't. But he was certainly successful in throwing his pursuer right off the scent.

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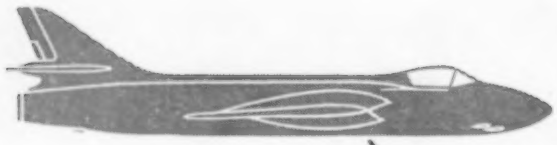

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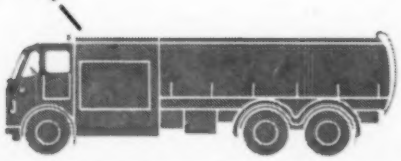

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Military Aircraft 1954

Trainers

weight, 5,600 lb; max. speed, 218 m.p.h. at 6,000ft; service ceiling, 23,950ft; range, 870 miles.

Piaggio P.148. This neatly-designed trainer can be supplied as a two-seater (aerobatic) or three-seater. The engine is a Lycoming 0-435-A. Span, 36ft 6in; length, 27ft 8in; gross weight (two-seater), 2,650 lb; max. speed at sea level, 145 m.p.h.

NETHERLANDS

Fokker S.14 The Editor remarked in his appreciation of the S.14 Mach Trainer (*Flight*, January 15th, 1954) that it has some formidable competitors, with side-by-side or tandem seating, but has certain advantages over all others. An extract from his report reads: "For a few minutes I turned the S.14 around and realized how at home I was beginning to feel. The controls are nicely harmonized and the loads are light. The ailerons feel very light at 35,000ft but remain effective at low speeds . . . Warning of the stall is adequate and such that you can hold the aircraft shuddering round yet under full control." The engine is now a Rolls-Royce Nene 3. Span, 39ft 5in; length, 43ft 8in; gross weight, 12,230 lb; max. speed at 20,000ft, 516 m.p.h., min. speed at sea level, 90 m.p.h.; climb to 30,000ft, 8.6 min; take-off distance to 50ft, 800 yd.

SWEDEN

Saab-91B Safir. Known in the Royal Swedish Air Force as the Sk 50, this type is produced at the Dutch De Schelde works. It has a Lycoming 0-435-A engine and has side-by-side seats. Span, 34ft 9in; length, 26ft; gross weight (aerobatic), 2,320 lb; max. speed, 170 m.p.h.

U.S.A.

Beechcraft T-34A Mentor. A development of the Bonanza, this tandem two-seater has a Continental 0-470-13 engine. Span, 32ft 10in; length, 25ft 10in; gross weight, 2,900 lb; max. speed at sea level, 188 m.p.h.; stalling speed, 53.5 m.p.h.; max. range, 975 miles; take-off to 50ft (no wind), 1,030ft.

Cessna T-37A. A million-dollar "letter contract" has been awarded to the Cessna company for side-by-side seat trainers, designated as above, and powered with two Marboré 2 turbojets. Span, 33ft; length, 27ft; gross weight, about 5,600 lb.

Convair T-29C and D. The most recent developments of the T-29 aircrew trainers, these machines have Pratt and Whitney R-2800 engines. The "D" is specifically laid out for bombing training and has no astrodomes, as had earlier variants. Span, 91ft 9in; gross weight, 43,575 lb.

Lockheed T-33A and TV-2. These designations, respectively, cover the U.S.A.F. and U.S. Navy trainer developments of the F-80 fighter. The power plant is the Allison J33-A-35 and armament two 0.5in guns. A Canadian version—the Silver Star—is powered with a Rolls-Royce Nene and is in an advanced stage of production.

Lockheed Experimental Trainer. This T-33A development has a raised canopy and rear seat, a braking parachute, and leading-edge slats.

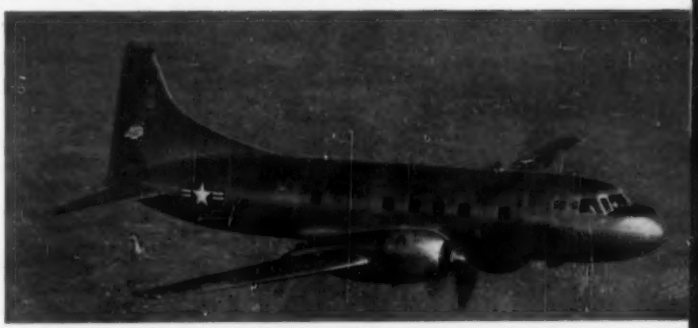
North American TF-86. A tandem two-seater related to the F-86F fighter/bomber, this has a longer fuselage and the slatted leading edge of the earlier Sabre fighters. Provision is made for armament. Span, 37ft; speed, over 650 m.p.h. at sea level; gross weight, about 17,000 lb.

North American T-28A and B. These are powered, respectively, with the Wright R-1300-1 and the Wright R-1820. Features are a nosewheel undercarriage and high-placed cockpits. Span, 40ft 1in; length, 32ft. Top speed (T-28B) is 343 m.p.h.

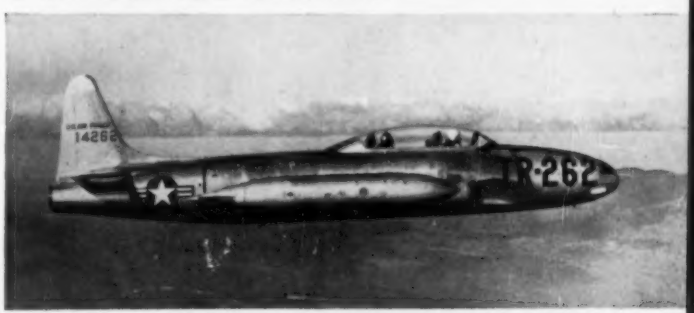
Temco Plebe. A neat tandem two-seater, powered with a Continental 0-470-13, the Plebe is one of the most up-to-date machines of its class. Span, 31ft 3in; gross weight, 2,500 lb; max. speed, 185 m.p.h.

Saab-91B Safir (Lycoming O-43-5A).

Beechcraft T-34A Mentor (Continental O-470-13).



Convair T-29D (two Pratt and Whitney R-2800).



(Above) Lockheed T-33A (Allison J33). (Below) North American TF-86 (General Electric J47).

Military Aircraft 1954

Westland-Sikorsky Whirlwind (Alvis Leonides).

UTILITY

Search and rescue in and over the wastes of the ocean, the Arctic and desert; experimental work with new equipment, armament and power plants; observation of trials; radar calibration—these are but a few of the manifold tasks for which various sorts and sizes of aircraft must be at the disposal of a major modern air force. Illustrated on this page are some of the machines available today.

That the helicopter should be so prominently represented is not, of course, surprising, in view of its ability to make "spot" landings and take-offs, to hover patiently and mercifully over the scene of a disaster, and to lift men or objects with impartiality and set them down again with unrivalled precision.

A machine of special significance is the McDonnell XV-1 convertiplane—forerunner of a series of much larger machines which are expected to vie with conventional aeroplanes in speed and range, and with the "straight" helicopter in "hoverability." The XV-3 of the Bell Aircraft Corporation is believed to have tilting rotors (i.e., the same airscrew/engine combination is rotated through a 90 dec arc for vertical lift and forward speed), while Sikorsky are experimenting with the retractable rotor principle, which allows the rotor to be braked and withdrawn into the fuselage for forward flight. The possibilities of such aircraft as these experiments portend are as yet hardly calculable.

For the present, however, a number of fixed-wing aircraft are rendering altogether admirable service, notably the Grumman SA-16 Albatross amphibian, of which about 300 have been supplied to the U.S.A.F. alone. The last production models of this aircraft were of the "triphibian" type, with sprung skis under the hull and small skis under the wing-tip floats to enable the machine to operate from land, water, ice or snow.

The adaptations of erstwhile first-line arcraft are far too numerous to be listed here; yet many are of great significance. Some act as radio-controlled "drones" for atomic experiments, others are target tugs or targets—though specialized pilotless target aircraft, such as the Australian Jindivik and America's Ryan Firebee, are becoming available in response to a pressing demand. Converted bombers serve as flying laboratories, as hacks for the development of new equipment, and as flying testbeds for new power plants, while machines of many types are now busily engaged in the vast missile programmes of the Powers.

S.N.C.A.S.O.1221 Djinn (Turboméca Palouste).

(Left) Saunders-Roe Skeeter (Blackburn Cirrus Bombardier). and (right) Bell HTL-4 (Franklin 6V4-200-C32).

Grumman SA-16A Albatross (two Wright R-1820-76A).
(Left) Hiller YHJ-1 Hornet (two Hiller 8RJRBC ramjets). and (right) Hiller H-23B (Franklin 6V4-200-C33).

Doman YH-31 (Lycoming SO-580-B).
McDonnell XV-1 (Continental piston engines).

DEUX MOTEURS

UN MEME ALLIAGE POUR LES AUBES

Le Bréguet 960 Vultur est un avion d'attaque embarqué destiné à la lutte anti-sous marine dont les essais d'appontage et catapultage ont été exécutés à Farnborough avec succès. Il est équipé d'un turbo-propulseur Armstrong Siddeley Mamba 3 monté dans le nez, pour des vitesses de croisiére jusqu'à 400 km/h. Dans le fuselage arrière est monté un turbo-réacteur Hispano-Suiza Nene à échappement dans la queue, pour le combat et la montée. Il permet des vitesses atteignant 900 km/h. Dans ces deux moteurs, les aubes de turbines sont en Nimonic 80 et les chambres de combustion en Nimonic 75.

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35 YEARS AFTER

THE unveiling at London Airport on June 15th, of the memorial to Sir John Alcock and Sir Arthur Whitten-Brown brought back vivid memories of their arrival at Euston Station after they had made the first non-stop flight across the Atlantic, on June 14th and 15th, 1919. The actual landing was unfortunate, in that it was made on boggy land and the Vickers Vimy stood on its nose.

At every stop on the way from Holyhead to London they were greeted by cheering crowds. Capt. Vickers and Rex Pierson, the designer of the aircraft, travelled with them and the party was joined at Crewe by Claude Johnson, then managing director of Rolls-Royce Ltd. At Euston a tremendous (and largely straw-hatted) crowd made it very difficult for the police to clear a way for them to board Sir Francis McClean's famous white-painted Rolls-Royce car, which was then almost a landmark at every aeronautical function. Eventually, however, a procession was formed leading to the Royal Aero Club where, after the official reception had finished, the two airmen presented themselves on the balcony to the big crowds waiting outside. The excitement of the occasion had been heightened by the arrival at Euston of Harry Hawker, who had been rescued after being forced down in the Atlantic consequent on an engine failure.

The scene at Euston Station as Capt. John Alcock and Lt. Arthur Whitten-Brown (they were knighted later) left for the Royal Aero Club in Col. McClean's car.

"Flight" photographs

Mr. Lennox-Boyd unveils the memorial to Alcock and Brown at London Airport. Later it will be moved to a position near the permanent buildings in the centre of the airport.

Last week's ceremony was placid by comparison, yet all round was the daily life of the busy international airport from which a Stratocruiser was then making the 14,150th scheduled Atlantic crossing by B.O.A.C. and its predecessors. In a brief speech before the unveiling, Lord Brabazon painted a picture of flying as it was in 1919, reminding his listeners that in those days the employment of two engines did not necessarily give added safety but more often doubled the expectation of trouble.

Mr. Lennox-Boyd, Minister of Civil Aviation, who unveiled the memorial, said that contributions towards its cost of £5,000 had come in from both sides of the Atlantic—between 400 and 500 Americans had subscribed, including Col. Lindbergh, who eight years later was to make the first solo, non-stop crossing.

Many of the pioneers of British aviation were present at London Airport. A group from Vickers included 12 men who worked on the construction of the Vimy; and A. H. Couch and R. Dicker who were members of the Vickers ground party at St. John's, Newfoundland, where the flight started. J.Y.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Too Many Hands?

YOUR leading article in the June 11th issue, whilst it has undoubtedly a good motive behind it, calls for some comment.

You criticize close allies working along parallel lines to develop certain kinds of expensive equipment, but your solution does not seem to be far different from nationalization of the industry.

Your suggestion is that the brains of both of two allies should be put together and that the work should then be shared out; but who would get what share? And what would happen to your smaller companies who would not be asked to partake in this exchange of views, but on whom, for some types of work, our country is entirely dependent?

The fairest share possible could be meted out only by an impartial third party; such a party does not exist, other than the Government, and one wonders sometimes how impartial they would be.

There are some other things which want looking into which are much closer at home and are not of an international nature. It is possible, today, for a company to spend two years, or more, in developing an item of equipment, and then for the fruits of its labours to be spread amongst half a dozen or more other companies, on the grounds of economy, through competitive tender. True, a designing firm is supposed to get the first contract, but that first contract can be a very small one and the subsequent one comparatively large. (I quote from actual cases.)

In any case, this open-tender business is costing a lot of money and endangering the financial stability of a lot of skilled firms with design facilities. It is also employing a lot of Civil Servants, who seem to have embedded in their minds that any job which comes along must be submitted to all and sundry, quite irrespective of the technical skill of the one firm that designed it and knows all the answers.

I suggest, therefore, that it would be better to put our own house in order in this direction first, before we presume to tell our allies how we should work together more economically in our common cause. If we don't, and if we take your suggestions too literally, we shall find even the aircraft industry drifting into that frightful state called nationalization, which will be the ruin of this country if we adopt it for our basic industries.

London, S.W.1. MUSKETEER.

Agricultural Aircraft—New Figures

THE abstracts from the Sydney R.Ae.S. symposium on "Aircraft in Agriculture," which appeared in your June 4th and 11th issues, were extremely interesting, although it was disappointing to find that there were only two British aircraft

CORRESPONDENCE . . .

amongst those under consideration.

It was unfortunate, therefore, that the information used on one of them, the Prestwick Pioneer, was somewhat out of date, and the comparison of take-off distance, which is obviously an important factor in this type of operation, was inclined to be misleading, in that in some cases take-off distance to 50 ft was given and in others what appeared to be take-off ground run.

For instance, a payload of 1,090 lb with 40 gal of fuel and a take-off distance of 230 yd (to 50ft) was shown for the Prestwick Pioneer, as compared with 1,800 lb payload with 20 gal of fuel and a 185-yd take-off distance (obviously ground-run) for the nearest overseas type.

The all-up weight and payload of production models of the Prestwick Pioneer has in the meantime been increased by 400 lb, and the comparison would now read, for the Prestwick Pioneer, 1,500 lb payload (plus 30 cu ft hopper) with 20 gal fuel and a take-off run of 80 yd, as compared with the 1,800 lb payload and 185-yd take-off ground-run of the transatlantic type.

Prestwick Airport. D. F. McINTYRE,
Managing Director, Scottish Aviation, Ltd.

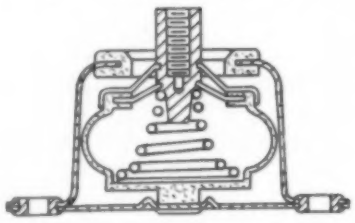
FORTHCOMING EVENTS

June 24-25. Women's air rally, Deauville.
June 24-28. Royal Danish Aero Club: World Model Glider Championship Odense.
June 26. Plymouth Air Display Committee: A irdisplay.
June 26-27. Aero-Club de Fleurs de l'Orne: Normandie Rally.
June 27. Aero Clubs of France and Marseilles: International speed contest, Marseilles.
June 29. Milan Aero Club: Milan Grand Prix
July 3. R.N.A.S. Ford: Air Day.
July 3. R.N.A.S. Eglinton: Air Day
July 3. R.N.A.S. Bramcote: Air Day.
July 3-5. R.Ae.C. members' Deauville Rally.
July 3-5. Swiss watch rally, Bienne, Switzerland.
July 4. Cote d'Argent Aero Club: Rally, Royan, Charente Inférieure.
July 8-12. British Institution of Radio Engineers: Industrial Electronics Convention, Oxford University.
July 9. College of Aeronautics Students' Society: Annual presentation ball, Cranfield.
July 10. R.N.A.S. Lossiemouth: Air Day.
July 10-11. International Radio Controlled Models Society: Annucl contests, Birmingham.
July 10-12. R.Ae.C. members' La Baule rally.
July 18. Yorkshire Aeroplane Club: "At Home," Sherburn-in-Elmet.
Sept. 7-12. S.B.A.C. Farnborough display and exhibition.

THE INDUSTRY

Shock Mounts by Muffelite

A WIDE range of anti-vibration and shock mounts is to be manufactured under licence from the Barry Corporation, Massachusetts, U.S.A., by Cementation (Muffelite), Ltd., of 39 Victoria Street, London, S.W.1. The anti-vibration mounts have been specially developed for use with airborne equipment of all types; the shock mounts are primarily intended for use in vehicles and ships, but also have certain aircraft applications. The British company is now tooling up to produce, by August, air-damped anti-vibration mounts and two types of shock mounts. In the meantime, American-made samples are available for test purposes.



Section of air-damped mounting, showing synthetic rubber bellows surrounding the load-carrying spring.

In the anti-vibration mounts non-linear springs are employed to maintain substantially constant natural frequencies over a wide load-range, and are stated to have an exceptionally low natural frequency of 7 to 9 c.p.s. Pneumatic damping is provided by a bellows made of cold-resistant synthetic or silicone rubber and having a small vent in its cap.

Initially, the shock mounts manufactured here will be of the rubber-cushion type designed to absorb high impact-shocks as well as to isolate frequencies above 2,000 c.p.m. The devices, known as Barrymounts, comply with American specifications and also with corresponding British specifications.

Drive Overload Protection

AVAILABLE in a number of sizes to cover various ranges of loadings, a series of torque-limiters has been developed by Fords (Finsbury), Ltd., of Kempston, Bedford.

The Ford torque-limiter is a basically simple device having application in a wide variety of mechanisms which require provision for automatic and instantaneous disengagement of a drive when an overload is imposed. It can be used as a coupling in a shaft, combined with a pulley, sprocket or gear-wheel, or arranged to operate an electrical cut-out switch.

A valuable feature of the device—and an essential one in certain applications—is that when the overload has been cleared and the machine re-started, it automatically resets itself with driving and driven elements in their original angular relationship.

As an indication of dimensions and weights, the No. 10 limiter (adjustable to transmit any required torque load between 100 and 400 lb in) is 10½in long, has a maximum diameter of 4½in, and weighs 12½ lb. It has a 1in shaft at one end and a 1in socket at the other, both with standard key-ways.

Marconi/I.A.L. Syrian Contract

ACTING in collaboration, Marconi's Wireless Telegraph Co., Ltd., and International Aeradio, Ltd., have secured "a substantial contract" for radio communication and direction-finding equipment from the Syrian Ministry of Defence.

Obtained in the face of strong foreign competition, the contract entails the planning and installation of a network which is to include automatic and manual V.H.F. D/F. stations (both mobile and static) with associated V.H.F. ground/air communications facilities.

A training school for Syrian Air Force personnel is also to be provided, the two companies being responsible for every phase, from the planning of buildings and the provision of technical equipment down to such ultimate details as exercise books for the students.

The respective rôles of Marconi's and I.A.L. are strictly complementary, the former supplying the equipment and the latter providing the specialist staff and training facilities in Syria itself. In England, the Marconi College—which was the first radio school in the world—will also be used for the training of Syrian personnel.

IN BRIEF

Mr. W. Elson, M.B.E., M.I.Prod.E., A.F.R.Ae.S., informs us that he has resigned his position as production manager to Hunting Percival Aircraft, Ltd., after eight years' service.

* * *

From Emco Brass Mfg. Co., Ltd., Westwood, Margate, Kent, comes an 84-page illustrated catalogue of refuelling-equipment fittings for almost every imaginable application. The company are suppliers of such components to well-known manufacturers of refuellers, and to petroleum companies.

* * *

Elliott Brothers (London), Ltd., announce the appointment of Mr. E. B. Schofield as area sales engineer for Lancashire, Cheshire and the West Riding of Yorkshire. He will specialize in the electrical measuring-instrument side of the company's business and will operate from the office at 66 Deansgate, Manchester, 3.

* * *

In a recent news-item reporting a visit to the U.S.A. and Canada by Mr. Clifford Shaw, of Shaw Processes, Ltd., a typographical error may have caused misunderstanding. The last sentence of the paragraph should have stated that Mr. Winnett Boyd was formally (not "formerly") appointed to represent Shaw Processes, Ltd.

* * *

At the annual dinner of the London Chapter of the Acheson Twenty-five Year Club, held recently at the Goring Hotel, Mr. G. A. Turner was elected president and Mr. F. Gordon Kay secretary for the ensuing year. Mr. Howard Acheson, chairman and managing director of Acheson Colloids, Ltd., referred to the fact that those present had been working for 25 years or more to develop the ideas of the founder of the company, Dr. Edward Goodrich Acheson, whose contributions to industry included "Carborundum," electric-furnace graphite and a wide range of colloidal dispersions.

MR. E. W. J. BARRINGTON, who was appointed deputy service manager of Rotax, Ltd., last January, now becomes service manager. He will be responsible also for spares and repairs, and for investigations into customers' reports.

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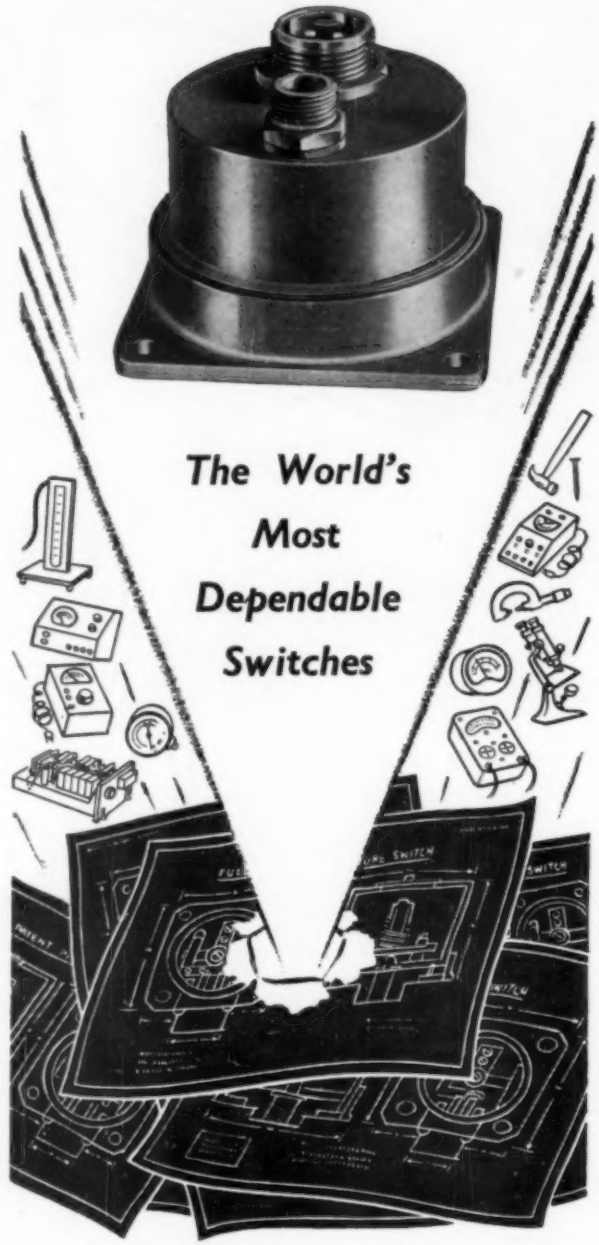

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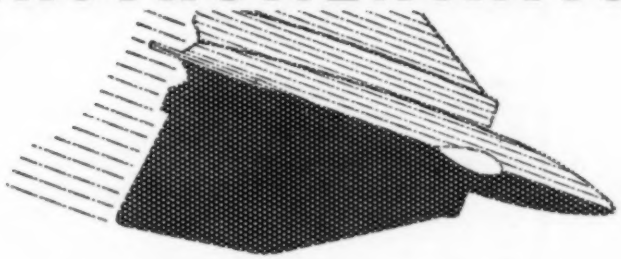

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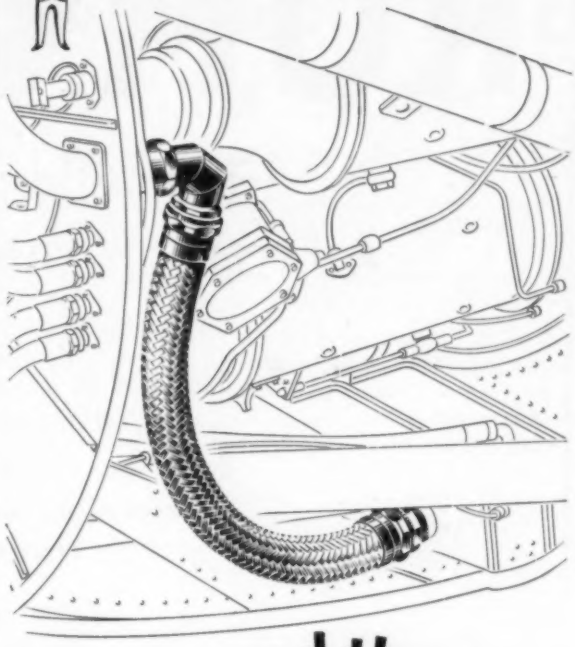

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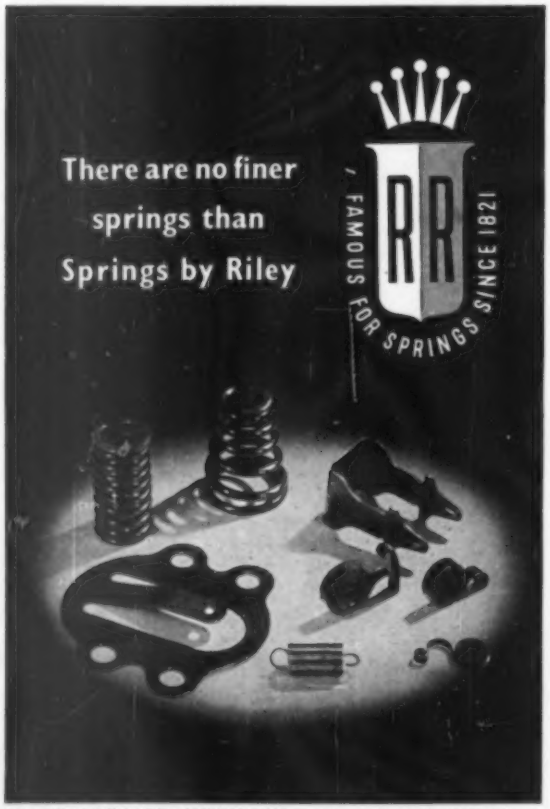

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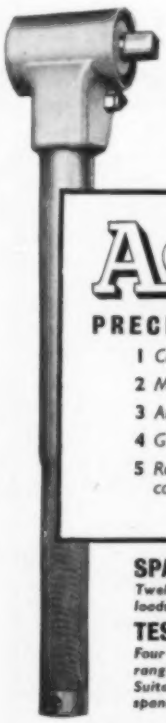

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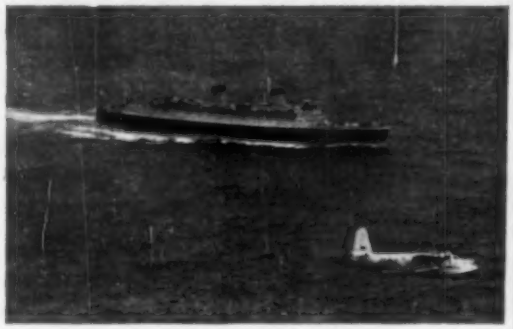

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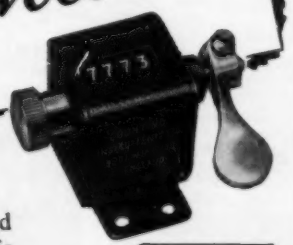

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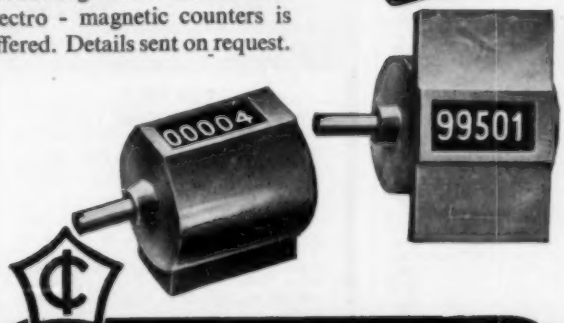

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned application to operate a scheduled air service:
APPLICATION No. 307 from Dragon Airways, Ltd., of Speke Airport, Liverpool, for a U.K. internal service with D.H.89 aircraft and later possibly with Prestwick Pioneer aircraft, for the carriage of passengers, supplementary freight and mail between Liverpool (Speke) and Glasgow (Renfrew), with an intermediate traffic stop at Prestwick (on demand), at a frequency of from two to seven services weekly for a period of seven years commencing one month after date of approval.
THIS application will be considered by the Council under the terms of reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to this application must be made in writing, stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9 Buckingham Gate, London, S.W.1, from whom further details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [2217

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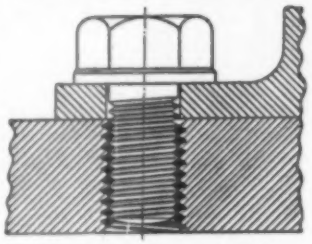

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The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 *or a woman aged* 18-59 *inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order* 1952.

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5. Technical assistant for development work on aircraft hydraulic systems (H.N.C. standard). Experience of aircraft hydraulic components required, together with knowledge of properties of modern hydraulic fluids.
6. Technical assistant for development work on aircraft electrical system and components including d.c. and a.c. generators and control gear. H.N.C. standard in light electrical engineering or combined electrical engineering and electronics an advantage.

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SITUATIONS VACANT

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APPLICANTS should be 23-30 years of age and of exceptional resourcefulness and initiative. Education must be to the standard of a Higher National Certificate in mechanical or production engineering, preferably including industrial administration subjects. Practical workshop experience is essential.

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TECHNICAL executive to administrate and operate the technical policy of the guided weapons division of a leading British company in its field, engaged in the design and development of specialized ancillary equipment for guided weapon projects.

A GOOD degree, with honours, or at least relative professional qualifications, backed by some specific theoretical and practical experience of electrical and hydraulic systems, servo mechanisms, gyroscopes, and general instrumentation are imperative, whilst some aerodynamical knowledge and/or experience, though not essential, would be useful asset.

THE post demands drive, enthusiasm, initiative and administrative ability, where a proven record of past achievement will justify a starting salary of upwards of £2,000 p.a. Age range 35-50. Staff pension scheme and housing assistance.

SEND full record and salary required to Box 6132. [2226

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COMMERCIAL pilot with Rapide and Auster endorsements wanted (mainly for pleasure flying) June to September.—Apply, with details of flying experience, to Pine's Airways, Ltd., Blackpool Airport. [2216

JIG and tool draughtsman (senior) required. Good welfare facilities including staff pension scheme.—Applications, in writing, to Personnel Manager, Hunting Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0593

SENIOR and intermediate design draughtsmen, with good experience of aircraft or light structural or mechanical engineering, required for aircraft and armament project work—Apply, by letter, to Portsmouth Aviation, Ltd., The Airport, Portsmouth. [0612

TECHNICAL illustrators (male, senior) required. Considerable practical experience of illustrating for sales brochures and descriptive manuals essential. Good welfare facilities including staff pension scheme.—Applications, in writing, to Personnel Manager, Hunting Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0592

SEVERAL senior draughtsmen with experience of turbine engine installations required immediately for both fixed and rotating wing installations. Good welfare facilities including staff pension scheme.—Applications, in writing, to the Personnel Manager, Hunting Percival Aircraft, Ltd., The Airport, Luton, Beds, stating age, experience and salary required. [2223

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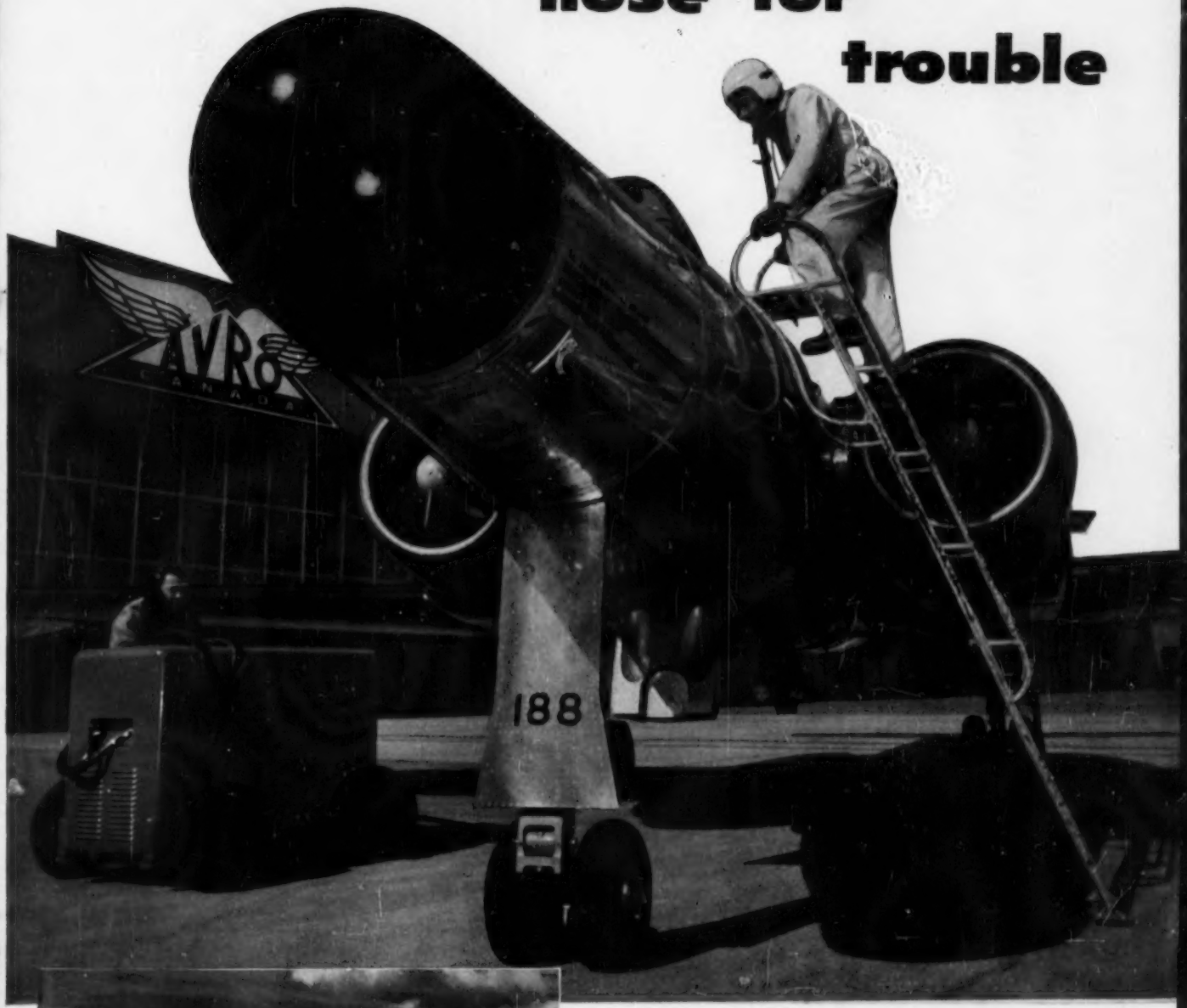

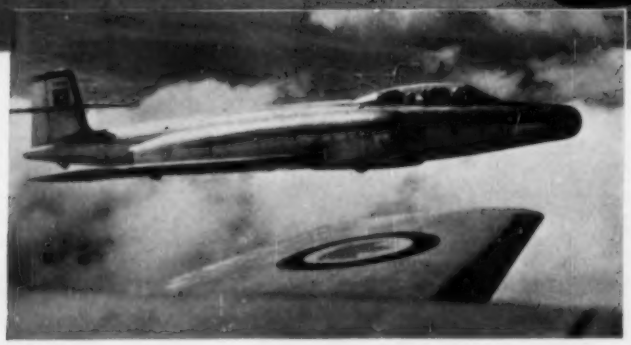

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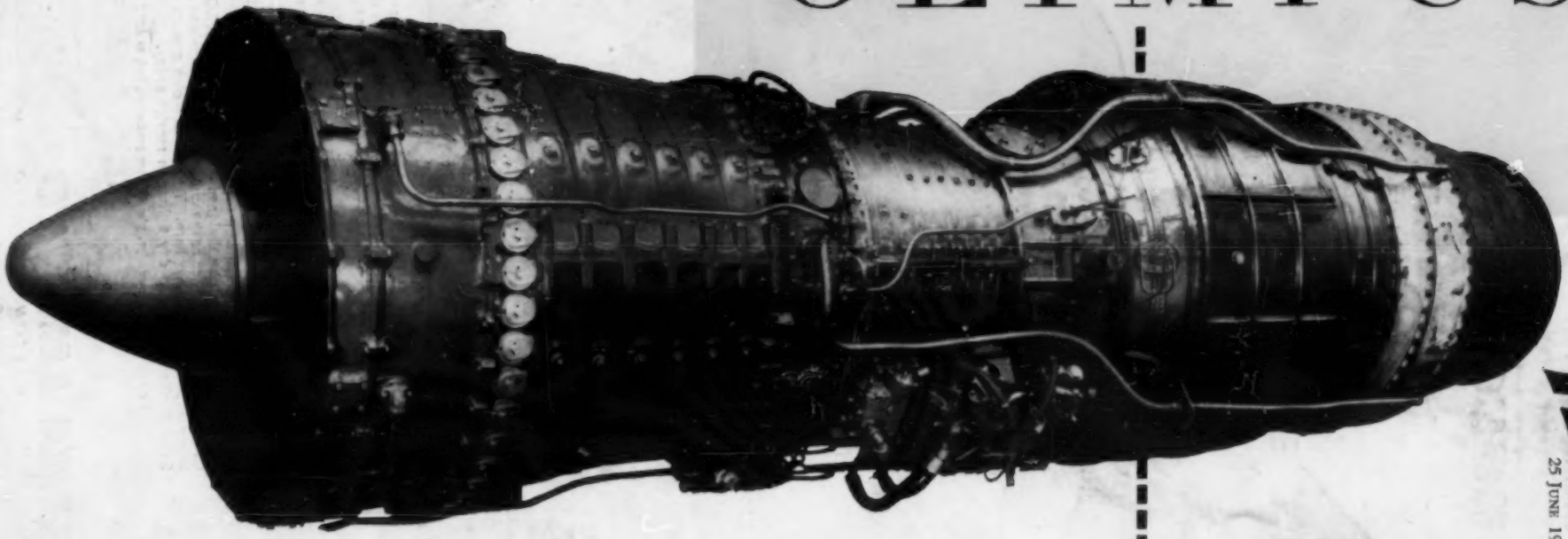

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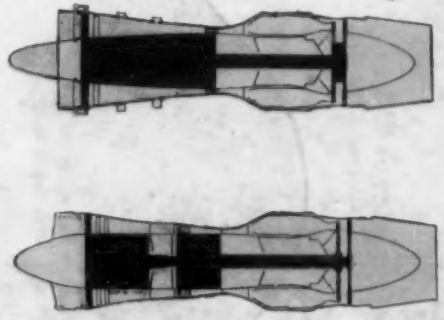

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